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Vol. 24, No. 7

JULY 1955

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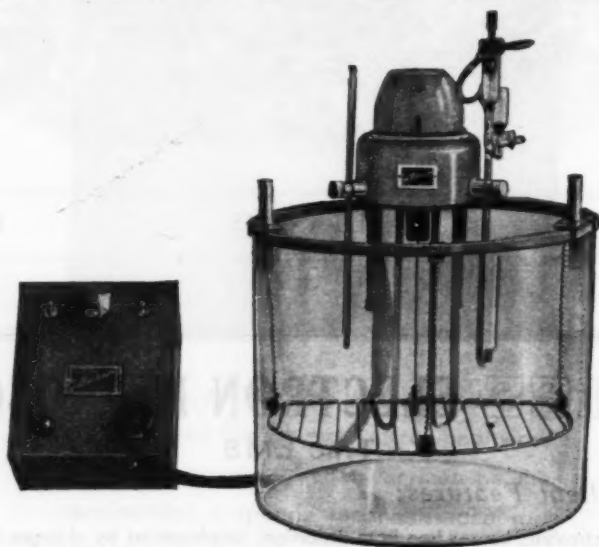
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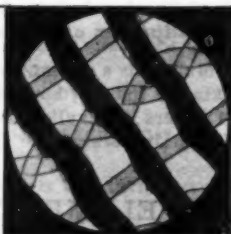
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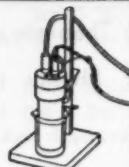


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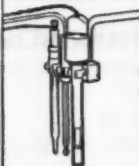
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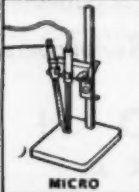
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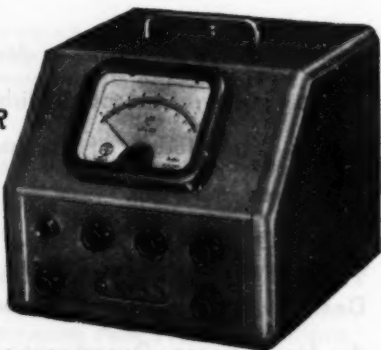
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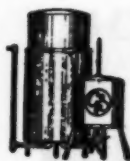


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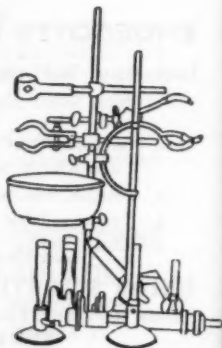
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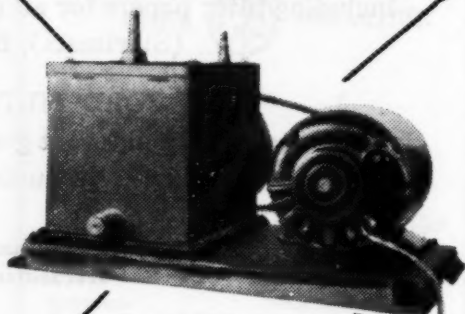
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# Current Science

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## NATIONAL RESEARCH DEVELOPMENT CORPORATION OF INDIA

WITH the establishment of a chain of national laboratories and the quickening tempo of research, the gap between research and development tends to become a wide one, and the need was being felt for sometime for a special organisation to bridge this gap. The Council of Scientific and Industrial Research had proposed the setting up of a National Research Development Corporation of India for this purpose, on lines similar to those in the United Kingdom and Canada. The recommendation was supported by the Planning Commission, and with the approval of the Government of India, the Corporation was established in December 1953, the following constituting the first Board of Directors: Shri Kasturbhai Lalbhai (*Chairman*), Lala Shri Ram, Dr. S. S. Bhatnagar, Dr. V. A. Sarabhai, Shri P. A. Narielwala, Shri M. D. Chaturvedi and Shri M. S. Bhatnagar.

The main function of the Corporation is to stimulate development of patents and inventions arising out of researches conducted in research institutions financed out of public funds, and where feasible, of patented inventions from private individuals also when such development is in public interest. The Corporation has no statutory powers of compulsorily acquiring patents and inventions; it can only do so by agreement and negotiation.

The Corporation has been functioning for more than a year, and the first annual report which has been published gives details of its work during the period. A major concern of the Corporation during this period has been to settle the preliminary details and arrangements for the acquisition of patents and inventions for developmental purposes. It has been decided that work in connection with the exploitation of Government-owned patents as

well as that relating to the development and exploitation of CSIR patents and inventions be transferred to the Corporation. (Patenting of inventions and renewal of patents however continues to be the responsibility of the CSIR.) During the year under review, the assistance of the Corporation has also been sought, by the Central Laboratories for Scientific and Industrial Research, Hyderabad (Dn.), Indian Lac Research Institute, Ranchi, College of Engineering and Technology, Calcutta, as well as by a number of private inventors.

Development of inventions by the Corporation is secured by arranging large-scale trials in co-operation with industry, or licensing out patents and inventions to industrialists for large-scale production depending upon the nature of the work and the stage to which laboratory investigations have been pursued. The reports received from research institutions are carefully scrutinised to examine the stage to which laboratory investigations have been conducted and decide whether further pilot or large-scale trials are indicated to develop the research work and establish its practical and economic possibilities.

In cases where large-scale trials at an industrial plant are necessary, as when the investigations have a bearing on industries already established in the country, the Corporation selects, in consultation with the research organisation concerned, the factory where the trials are to be conducted and settles with the firm details regarding expenditure on the conduct of the trials and the concessions which the firm is to receive in return for facilities afforded. A model developmental licence agreement to define the rights of the parties has been drafted and is entered into between the Corporation and the firm before trials are undertaken.

Where laboratory investigations are complete and no further pilot or large-scale trials appear indicated, a non-technical note is published and

circulated to chambers of commerce, scheduled banks, insurance companies, directors of industries of States, associations of industries likely to be interested in the development of the process and a large number of prominent industrialists. Interested parties are encouraged to examine samples and comment on them. Such information as can be released in the preliminary stages is made available. Terms for the licensing of the process are negotiated, keeping in view the scope of its application, the likely demand and feasibility of arranging production at more than one centre. If a process has a limited application, exclusive licences may be issued. Where wider possibilities of application appear possible, zonal or non-exclusive licences are considered. In cases where the process is of a general application it may be allowed to be used by all interested parties.

Upto the end of the period under review, 177 inventions from various institutions were handled by the Corporation and 62 processes are under critical examination. Plans for the development of the Corporation include a Survey and Statistics Section with a view to (i) study the economic significance of researches reported for development and keep abreast of developmental trends; (ii) conduct an effective market research and a feasibility study for the promotion of products and processes; and (iii) examine and classify patents and information on processes and supply the National laboratories with references and information on all available processes and patents concerning any particular development. An Industrial Relations Section for more effective liaison between research and industry is also contemplated.

The Corporation has made a good beginning and it is to be hoped that it will play an increasingly important part in the development of our industrial methods.

#### RADIO WAVES FROM JUPITER

**R**ADIO wave emission from the planet Jupiter has been detected by Dr. B. F. Burk of the Carnegie Institute, Washington D.C., and confirmed by workers in the Radiophysics Division, the Commonwealth Scientific and Industrial Research Organisation, Australia. The discovery is quite unexpected.

Dr. Burk's observations were made on a frequency of 22 megacycles a second, which corresponds with a wavelength of about 14 metres. It was by chance that the narrow field of view

of the telescope—one and a half degrees wide—included Jupiter. Short bursts of radio emission of about one second duration were noticed, and for more than a month the movement of Jupiter was followed. The fact that the bursts are of short duration suggests a more or less localized origin, and the fact that they have been detected only on one day in three may be connected with the rotation of the planet, which has a "day" of 9 hr. 50 min.



No. 7  
July 1955]

## BREAKS IN INDIAN SOUTHWEST MONSOON AND TYPHOONS IN SOUTHWEST PACIFIC

C. R. V. RAMAN

*Regional Meteorological Centre, Bombay*

ONE of the important features of the Indian southwest monsoon is the trough of low pressure which extends from northwest India to Orissa. The axis of this trough runs on the average from Hissar in the Punjab through Agra and Allahabad to the head of the Bay of Bengal in the mid-monsoon month of July. The winds are westerly to the south of the axis, while to the north, they are easterlies. This axis does not remain stationary, but it moves north or south of the normal position and affects the rainfall distribution over the country as it moves. Sometimes, the axis of the trough shifts north and lies possibly over the Himalayas. When this happens westerlies sweep across the Gangetic Plain and the easterly flow is totally absent. This is called by the Indian Meteorologists as a 'break' in the monsoon'. In such situations the rainfall is mostly confined to the foot of the Himalayas and is also heavy. There is a general decrease of rain over the rest of the country.

Malurkar<sup>2</sup> has concluded that the shift of the axis of the monsoon trough northwards may be taking place at a time when one of the stationary low pressure areas in West China or Chinese Turkestan gets accentuated. This accentuation may be partly due to the more southerly travel of extra-tropical disturbances than usual. He has also said that the travel of a low pressure area or 'pulse' south of the equator into the southwest Arabian Sea may give rise to a 'break' in the monsoon in the Indian area. Koteswaram<sup>3</sup> has mentioned that the westward movement of an upper 'low' at low latitudes across the Indian area is often associated with a 'break' in the south-west monsoon. Parthasarathi<sup>4</sup> has recently discussed some aspects of breaks in the monsoon during 1954.

In this note, an attempt has been made to trace the relationship between the 'breaks' in the southwest monsoon in India and the movement of depressions or typhoons in the southwest Pacific. The typhoon tracks published by the Royal Hongkong Observatory in their 'Meteorological Results—Part I', have been used in this study. The positions of depressions and typhoons mentioned in the note hereafter refer to 00 GMT. The axis of the monsoon trough

in India has been traced from the daily wind distribution at 3,000' at 0200 GMT. The study covers the months of July and August in the six years, 1947-52.

A close correlation has been found to exist between the position of the axis of the monsoon trough and the position of typhoons in the China Seas. As depressions or typhoons in the southwest Pacific located between longitudes 110° E. and 140° E. crossed over to the north of Lat. 30° N., the axis of the monsoon trough over India moved into the Himalayas. Six specific instances in support of the above are given in Table I. It was seen that in five of these cases the axis of the monsoon trough moved to the foot of the Himalayas within a day of the depression or typhoon in the China Seas crossing to the north of Lat. 30° N.

TABLE I

No.	Date on which depression or typhoon in S.W. Pacific crossed to the north of Lat. 30° N. with position of the centre on that date	Date on which the axis of the monsoon trough over India at 3,000 ft. shifted close to the foot of the Himalayas
1	9-7-1947 (31.4° N., 130.3° E.)	9-7-1947
2	7-8-1947 (33.3° N., 138.2° E.)	7-8-1947
3	17-7-1949 (31.2° N., 129.8° E.)	18-7-1949
4	16-8-1949 (32.7° N., 130.0° E.)	20-8-1949
5	5-7-1951 (32.8° N., 136.9° E.)	6-7-1951
6	22-8-1951 (32.6° N., 124.3° E.)	23-8-1951

Only in the August 1949 instance (16th-20th), did the eastern end of the trough begin to shift northwards after the typhoon moved to the north of 33° N. After the typhoon moved to 36° N. the trough shifted into the Himalayas. The instance of July 1949 is very striking in that the trough on the 16th was occupying an unusually southerly position between 21° N. and 22° N. Within two days this trough moved into the Himalayas coinciding with the movement of a typhoon from 27.8° N. to 34.1° N. The break that set in on 23rd August 1951 lasted practically till the end of the month.

Two more instances of the axis of the trough having shifted to the Himalayas with the depression/typhoon heading towards Lat.  $30^{\circ}$  N. occurred during the periods 27th-30th July 1947 and 10th-15th August 1950. In these two instances full information regarding the typhoon tracks is not available.

There have been six cases when the axis of the monsoon trough did not shift to the hills even though depressions or typhoons in the China Seas have crossed to the north of Lat.  $30^{\circ}$  N. These instances occurred during the periods 5th-9th July 1948, 27th-29th July 1949, 18th-21st July 1950, 26th-29th July 1950, 18th-20th July 1952 and 16th-19th August 1952. It was, however, noticed that at about that time, conditions have either been unsettled in the North Bay of Bengal or depressions have been present in the Indian area.

Even with no depressions in the Indian area, a few instances have been observed when the axis did not shift to the Himalayas in spite of the depression/typhoon in the China Seas having crossed to the north of Lat.  $30^{\circ}$  N. The noteworthy feature in these cases is that at the same time there were other typhoons or depressions in the southwest Pacific itself at more southern latitudes than the ones that had crossed  $30^{\circ}$  N. Two such instances occurred during the periods 23rd-25th July 1949 and 13th-15th July 1952.

Besides the cases mentioned above, there have been only two other occasions of break in monsoon in the months of July and August in these six years which it has not been possible to associate with published typhoon tracks available to the author. It is not known whether there were any typhoons to the east of Long.  $140^{\circ}$  E. during the period which have had any association with these two cases of breaks. It may be mentioned that all the typhoons which have crossed  $30^{\circ}$  N. to the west of  $140^{\circ}$  E. during these six years have been considered in this note.

From the above evidence the following correlations would appear to exist between the 'break in the monsoon' over India and movement of depressions or typhoons in the southwest Pacific: (i) When a depression or typhoon in the China Seas crosses to the north of  $30^{\circ}$  latitude the axis of the monsoon trough shifts into the Himalayas; (ii) This break does not

occur if simultaneously there is another depression or typhoon in the China Seas itself to the south of latitude  $30^{\circ}$  N. (iii) Unsettled conditions in the Bay of Bengal or a depression in the Indian area prevents the movement of the monsoon trough into the Himalayas even if a depression or typhoon in the China Seas has crossed  $30^{\circ}$  N. latitude.

The general circulation gives an easterly flow over the sub-Himalayan area above 4 km. during the months of July and August. Typhoons of the China Seas are intense systems which may affect the general circulation over a very wide belt. Hence it is probable that a typhoon near Long.  $120^{\circ}$  E., when it crosses to the north of Lat.  $30^{\circ}$  N. may affect the circulation westwards as far west as  $80^{\circ}$  E. and replace the prevailing easterlies by westerlies over the Indian area which lies to the south of the typhoon centre.

However, when there is a tropical cyclonic system in the Indian area itself, it is natural to assume that the far eastern typhoon is unable to replace the prevailing easterlies above 4 km. along the foot of the Himalayas by westerlies. Again, when there are two typhoons, one to the north of Lat.  $30^{\circ}$  N. and the other to the south of Lat.  $30^{\circ}$  N., their effect at the distant Indian latitudes may cancel out and under such a situation the prevailing easterlies over India may continue and the axis of the monsoon trough may not shift to the hills.

It is not contended that the typhoons in the China Seas are the only factor controlling the breaks in the Indian monsoon. Factors such as the unusual southward movement of the troughs in the westerlies further to the north of India may also have an influence on the occurrence of 'breaks'. This aspect of the problem is under investigation.

I am grateful to Dr. B. N. Desai and Mr. Y. P. Rao for their guidance in this investigation. I am also thankful to Dr. P. R. Plsharoty for going through the manuscript.

1. India Meteorological Department Technical Note, 1944, No. 1, 17.
2. Malurkar, S. I., *Memoirs of the India Met. Department*, 1950, 28, Part 4, 15.
3. Koteswaram, P., *Ind. J. Meteorology and Geophysics*, 1950, 1 (2), 162.
4. Parthasarathi, K., *Ibid.*, 1954, 5 (4), 328.

## ECTOPARASITES OF SOME BATS FROM INDIA

L. S. HIREGAUDAR AND D. V. BAL

Dept. of Zoology, Institute of Science, Bombay-1

OBSERVATIONS made on external parasites of bats from Bombay State and some other parts of India for the last three years show that Indian bats carry a rich fauna of ectoparasites, particularly Diptera and mites. Fleas and bugs have also been found in small numbers. Some of the parasites exhibit peculiar adaptations.

Stiles and Nolen<sup>1</sup> were the first to give a complete list of bat parasites then known. A reference to this list would show that comparatively few species of bat parasites have been carefully studied, particularly those from Indian bats. Of the pupiparous Diptera, the Nycteribiids and Streblids are exclusively parasitic on bats. A good deal of work has been done on their systematics and bionomics in some parts of the world but very little in India. Scott,<sup>2</sup> Bal and Ahmad<sup>3</sup> and Jobling<sup>4</sup> have studied about 18 species of Nycteribiids and 5 species of Streblids from Indian bats.

In all, 11 species of Nycteribiids, viz., *Basilina scotti*, *Penicillidia jennynsi* var. *indica*, *P. fletcheri*, *P. bombayensis*, *Nycteribia philipsi*, *N. allotopa*, *N. parvula*, *Cyclopodia sykesii*, *C. ferrarii*, *Tripselia aenulata* and *Eucampsipodia hyrtli orientalis* have been found during this study. Of these *Basilina scotti* and *Penicillidia bombayensis* are new to science and *Eucampsipodia hyrtli orientalis* is a new sub-species.

Of the family Streblidae, *Nycteribosca gigantea*, *N. amboinensis*, *N. modesta*, *N. taji* and *Raymondia joblingi* have been obtained during this investigation and of them *N. taji* and *R. joblingi* are new species.

Mites form another important group of external parasites which are encountered in large numbers on bats. Nothing is practically known about mites found on Indian bats excepting a few records by Oudemans<sup>5</sup> and Radford.<sup>6</sup> The bat mites are confined to the families Spinturnicidae, Macronyssidae (Liponyssidae), Myobiidae, Trombiculidae, Laelaptidae, Sarcoptidae, Listrophoridae and Spelerhynchidae. Of these the members of the first five are represented in our collection from Bombay State.

Under the family Spinturnicidae, *Ancyrtopus indica*, *A. kanheri*, *A. zelebori*, *Meristaspis*

*lateralis*, *Spinturnix psi*, *S. euryalis orientalis* and *Periglischrus rhinolophi* are recorded for the first time from India. Of these *A. indica*, *A. kanheri* and *P. rhinolophi* are treated as new to science and *S. euryalis orientalis* as a new sub-species. The specimens of *A. indica* and *A. kanheri* were collected from *Rousettus leschanaulti*, Bombay, 1953, and *P. rhinolophi* and *S. euryalis orientalis* from *Rhinolophus rouxi*, Tulsi Lake Tunnel, Bombay, 1953.

The family Macronyssidae is represented here by *Steatonyssus hubli*, *Ichoronyssus lingaraji* and *Hirstesia transvaalensis* and the first two species are new to science. *S. hubli* and *I. lingaraji* are obtained from *Pipistrellus ceylonicus chrysothrix*, Hubli, 1953, and *Taphozous longimanus*, Belgaum, 1954, respectively. *H. transvaalensis* from *Miniopterus fuliginosus*, Mahableshwar, 1953, agrees with the description given by Zumpt<sup>7</sup> but shows slight variations in the shape of the dorsal plate.

A record of *Neolaelaps magnistigmatus* belonging to the family Laelaptidae is made for the first time from India and it seems to be a common mite on flying-foxes.

Only three species of Myobiid mites have been collected from Bombay bats during the course of this investigation. Of these *Foliomyobia jamesonia* and *Neomyobia tulsi* are new species and *Foliomyobia barnleyi* has been recorded for the first time from India. *F. jamesonia* is found on *Rousettus leschanaulti* and *N. tulsi* on *Rhinolophus rouxi*, Bombay, 1954-55. *F. barnleyi* has been found to parasitise *Taphozous longimanus*, Bombay, 1952.

Of the two new species of Trombiculid mites reported here *Whartonia brentnania* is separated from *W. perplexa* in possessing much broader scutum and chelicerae with strong teeth. The specimens of this species were obtained from *Hipposiderus bicolor fulvus*, Karla Caves, Bombay, 1953. *Trombicula hampi* collected from *Rhinophoma hardwicki*, Hampi (Mysore State) is differentiated from *T. laveri* by the different standard data of measurements and by the bases of the sensillae, not being midway between the antero-lateral and postero-lateral setae.

Jordan and Rothschild<sup>8</sup> and Mathur<sup>9</sup> have reported a few bat-bugs from India. *Cimex*

pipistrellus and *Cacodmus indicus* were the only two species taken from house-bats during this investigation.

Smit<sup>10</sup> has recorded a few species of fleas from *Rousettus* and *Pipistrellus* groups of bats and *Thaumapsylla breviceps orientalis* was collected from *R. leschenaulti*, Kanheri and Elephantia Caves, Bombay, 1953.

1. Stiles and Nolen, *Nat. Inst. Hlt. Bul.*, No. 155, U.S. Treasury Dept., 1931.

2. Scott, H., *Red. Ind. Mus.*, 1925, 27, Pt. 5, 351.  
3. Bal and Ahmad, *Curr. Sci.*, 1949, 18, 179.  
4. Jobling, B., *Trans. Ent. Soc. Lon.*, 1951, 4, 211.  
5. Oudemans, A. C., *Ent. Ber. Amst.*, 1914, 76 (4), 65.  
6. Radford, C. D., *Parasitology*, 1950, 40, 366.  
7. Zumpt, F., *J. Ent. Soc. S. Afr.*, 1950, 13, 83.  
8. Jordan and Rothschild, *Nov. Zool.*, 1912, 19, 352.  
9. Mathur, R. N., *Ind. J. Ent.*, 1952, 14, 257.  
10. Smit, F. G. A. M., *Parasit.*, 1954, 44, 143.

### NEW AETHER DRIFT EXPERIMENT

THE possibility of performing an experiment similar to that of Michelson and Morley, but using short radio waves in the place of light waves has been discussed in several letters in *Nature*. Among them, the experiment described by L. Essen (*Nature*, 1954, 173, 734) has now been completed, and the results are reported by him in a recent issue of *Nature* (1955, 175, 793).

A cylindrical cavity resonator (of length 16.866 cm. and diameter 8.075 cm.) was used to control the frequency of an oscillator at approximately 9,200 mc./s. The resonator was rotated continuously in a horizontal plane at a rate of about one turn per minute, the frequency of the oscillator being measured by comparison with a quartz standard at intervals of 45° during the rotation.

The theory of the method may be described in the following way. The cavity resonates when its length is a whole number of half wavelengths and the resonant frequency is given by

$$f = \frac{v}{\lambda} = \frac{nv}{2l}$$

where  $v$  is the phase velocity,  $\lambda$  is the wavelength of the resonator and  $n$  the number of half wavelengths. In this condition the time taken for the phase of the wave to travel to and fro between the end faces of the resonator is  $1/f$ . If now because of the earth's orbital motion a relative velocity  $q$  be postulated between the resonator walls and the medium of propagation within it, then just as in the optical case, this time becomes:

$$t_1 = \frac{2l}{nv} \left(1 + \frac{q^2}{v^2}\right)$$

when the axis of the resonator is in line with the orbital motion and

$$t_2 = \frac{2l}{nv} \left(1 + \frac{1}{2} \frac{q^2}{v^2}\right)$$

when it is at right angles to it. The resonant frequency and therefore the frequency of the controlled oscillator should thus vary by a fractional amount of  $q/2v^2$  on rotation, there being two minima and two maxima for a complete rotation of 360°. The calculated frequency change is found to be 3 parts in  $10^9$  for the resonator and frequency employed, if the earth's orbital velocity is taken as 30 km./sec.

In the actual experiment, the observed change was of the order of 1 part in  $10^{11}$ , i.e., only about 1/300th of the expected change. Even this could be attributed to the changes of frequency produced by the presence of the earth's magnetic field.

It may be of interest to compare the above with the most recent optical results. In the precise determination made by Joos in 1930, the interference fringes were measured by a microphotometer, and it was concluded that there was a null result to  $\pm 0.001$  fringe or 0.3 per cent. of the expected displacement. Miller, however, who carried out the most extended measurements three years later, was critical of this result and published a paper in which he stated that there is a definite effect of about 8 per cent. of that anticipated. The present experiment suggests that Miller's conclusions cannot be accepted. The effect, if any, is shown to be not more than one-tenth of that reported by him, which must probably be ascribed to some systematic error.



PROF. GOBIND SINGH THAPAR\*

DR. GOBIND SINGH THAPAR, Professor and Head of the Department of Zoology at the University of Lucknow, has recently retired from University service.

Dr. Thapar held various appointments in colleges in the Punjab, before he went to Europe. In 1927, after his return, he was appointed Reader in Zoology in Lucknow University and University Professor in 1951.

Dr. Thapar's abilities were nowhere better displayed than in the organisation of a flourishing school of research in helminthology at Lucknow where many students obtained their research degrees under his inspiring guidance and are now occupying important positions in academic life at Lucknow and elsewhere.

Prof. Thapar has been running a Helminthiasis Scheme of the Indian Council of Agricultural Research for 16 years at Lucknow, and has made valuable contributions to the morphology, systematics and life-histories of the helminth parasites of the domesticated animals of India. He was mainly instrumental for the foundation of the Helminthological Society of India in 1948, and the *Indian Journal of Helminthology*. He has been the moving

spirit of the Society, and as the Editor of its Journal, has earned a great name for himself from helminthologists the world over.

Dr. Thapar has also donated all his personal collection of helminthological material consisting a large number of valuable types, co-types, etc., to the Helminthological Society of India, so that in due course, the Society can function as a Bureau for the supply of information on helminthology.

Dr. Thapar has been a President of Zoology Section of Indian Science Congress and a Fellow of various learned bodies, including the Zoological Society of India, the Indian Academy of Sciences and the National Institute of Sciences of India. Last November he was presented with a commemoration volume on his 60th birthday with contributions from the foremost helminthologists of the world.

Although Dr. Thapar has retired from the University, his activities in the scientific field have not ended. He has been persuaded by the Society to continue to edit the *Indian Journal of Helminthology* and he has agreed to accept the Chief Editorship with the collaboration of an Editorial Board formed at his suggestion.

Zool. Survey of India,  
Calcutta-12.

B. S. CHAUHAN.

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NATURE PROTECTION

SOIL, vegetation and fauna exist in delicate balance which has been interfered with by man time and time again. Untimely deforestation, for instance, causes erosion which may result in the devastation of whole areas; the use of insecticides may destroy parasites but also eradicates useful species, such as bees.

An exhibition recently opened at the Paris Natural History Museum depicts some of the consequences of man's untimely action. Entitled "Man against Nature", it has been organized with the support of UNESCO and the International Union for the Protection of Nature.

On UNESCO's request the Union has prepared a section of the exhibition devoted to the disturbance of natural balance, and illustrated by a dozen very striking examples. There is, for instance, the "conquest" of Australia by rabbits; twenty-four of these were brought into the country in 1859, and now millions of

them are destroying both natural and cultivated vegetation. Jamaica is devastated by the mongoose—introduced with the object of destroying rats which were pillaging the sugar-cane plantations; but the mongoose also attacks domestic animals and destroys harvests. In Africa, the destruction of the leopard has resulted in an enormous increase of baboons and wild pigs which eat up the vegetation. In other countries, the eradication of the otter has brought about the disappearance of fish—for the otter destroyed diseased fish, thereby preventing the spread of epidemics.

The exhibition will remain open until the end of September 1955. The section devoted to the disturbance of natural balance will later form an independent exhibit which the International Union for the Protection of Nature will place at the disposal of members wishing to circulate it in their countries.—UNESCO.



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## ON GÖDEL'S COSMOLOGICAL SOLUTION OF EINSTEIN'S GRAVITATIONAL FIELD EQUATIONS

GÖDEL<sup>1</sup> has obtained the curious solution :

$$ds^2 = a^2 \left[ dt^2 - dx_1^2 + \left( \frac{e^{2x_1}}{a^2} \right) dx_2^2 - dx_3^2 + 2e^{x_1} dt dx_2 \right] \quad (1)$$

of the field equations in the relativistic theory of gravitation (with the cosmological term  $\lambda$ ), viz.,

$$R_{\mu\nu} - \frac{1}{2} g_{\mu\nu} R + \lambda g_{\mu\nu} = -8\pi k T_{\mu\nu} \quad (2)$$

where

$$R = R_{\mu\nu} g^{\mu\nu}, \quad T_{\mu\nu} = \rho v_\mu v_\nu.$$

The above field equations are satisfied for the line element, if

$$\frac{1}{a^2} = 8\pi k\rho, \quad \lambda = -\frac{R}{2} = -\frac{1}{2a^2} = -4\pi k\rho \quad (3)$$

This solution obtained by Gödel is distinguished from the other known cosmological solutions of the field equations (2) in many interesting ways and has raised many new problems in the traditional treatment of the relativistic cosmology which are yet unanswered. In all the other solutions in relativistic cosmology that represent possible models of the universe, Weyl's postulate (i.e., the paths of nebulae lie in space-time on a bundle of geodesics diverging from a point in the distant past or future) and the postulate of homogeneity is assumed, in consequence of which

the space-time is split up into a time component orthogonal to the spatial group and a 'cosmic' or 'world-time' is defined contrary to the postulates of general relativity. Gödel has shown that the non-existence of one-parametric system of three-spaces orthogonal to the world-lines of matter shows rotational property in the universe. The arrow of time has no meaning in Gödel's solution and the notion of 'earlier-later' is to be abandoned in a cosmological sense.<sup>2</sup>

Earlier Gamow<sup>3</sup> has anticipated that rotating universe could be represented by anisotropic solutions of the field equations in relativistic cosmology. The significance of general rotation in the universe on the problems of cosmogony and in the determination of a true inertial frame for astronomical reference has been remarked also by Robertson.<sup>4</sup> The metric<sup>1</sup> is homogeneous and stationary, but not spherically symmetric. Einstein<sup>5</sup> had a belief that Mach's postulate (i.e., the inertia depends upon the mutual action of bodies) is at least partially contained in the field equations. But Gödel has given an example of a solution that goes against Mach's postulate. According to the view-point of idealistic philosophy,<sup>6</sup> the universe is given as many times as there are possible distributions of matter. Accordingly, the question of the existence of multiverses in Gödel's solution makes physical sense. Weyl's postulate is seen not to be strictly obeyed in this solution. The light tracks are found to be of the type

$$x_1 = \gamma, x_2 = \beta t, x_3 = at$$

Gödel's solution does not give the red shift of the nebulae and the problem whether Hubble's Law can be harmonised with a general rotation in the universe is still unsolved. In such a case a distinguished time direction may be related to the expansion of the universe and the concept of 'earlier-later' cannot be eliminated physically. Further details will be published elsewhere.

Thanks are due to Prof. V. V. Narlikar for his guidance and for suggesting the problem.  
Dept. of Mathematics, S. PATNAIK.  
Gajapathi College,  
Parlakimedi (Orissa), March 22, 1955.

1. Gödel, K., *Rev. Mod. Phys.*, 1949, 21, 447.
2. Einstein, A., *Library of Living Philosophers* (Evanston), 1949, 7, 687.
3. Gamow, G., *Nature*, 1946, 158, 549.
4. Robertson, H. P., *Proc. Amer. Phil. Soc.*, 1949, 93, 527.
5. Einstein, A., *Meaning of Relativity* (Methuen), 1953, 103.
6. Russell, B., *Principles of Mathematics* (Allen and Unwin), 1948, 493.

## ANOMALOUS REACTION OF WOOD ON PHOTOGRAPHIC EMULSIONS

In a previous note<sup>1</sup> in this journal, the author reported that the action of wood on different photographic emulsions did not run parallel to the photographic speed of the emulsion employed. It was then suggested, tentatively, that the inferior action observed in panchromatic and other high speed plates might be due to the presence in them, of dyes, which are introduced into them, to extend the range of their spectral sensitivity. This hypothesis has since been tested and confirmed by experiments.

In the present experiments eosin and erythrosin were used as sensitizers and the plates were half bathed in a very dilute solution of the dye in water (1:10,000) and air-dried.

The wood specimen, in this case the very active Salwood (*Shorea robusta*) was placed on the surface of the plate, and an exposure of 24 hours was given in total darkness as described in a previous note.<sup>2</sup>

The plate on development gave a picture of the wood, the intensity of which was perceptibly less in the dyed regions of the plate. A positive print of the picture obtained is reproduced in Fig. 1. The same effect was observed both

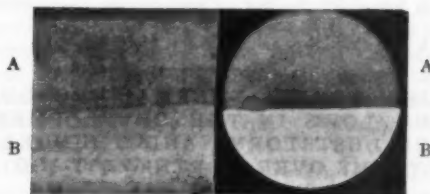


FIG. 1

Action of wood on photographic plate  
A—Dye-sensitized region  
B—Non-dye sensitized region

FIG. 2

Action of hydrogen peroxide on photographic plate  
A—Dye-sensitized region  
B—Non-dye sensitized region

Both figures are reproduced as positive prints of the original plates.

when the plates were dye-sensitized with eosin and erythrosin, and also when different types of plates were used.

The dyes used in the above experiments are reducing agents. Granting that the fogging action of wood is due to hydrogen peroxide<sup>3</sup> or some other form of organic peroxide, formed as a result of aerial oxidation, it stands to reason that the oxidising agents so formed act preferentially on the reducing dyes used to sensitize the silver halide emulsion. The dyes consequently act as a sort of a partial screen to the action of the fogging agents, thus account-

ing for the depressed activity in the regions covered by them.

The behaviour of hydrogen peroxide vapour itself towards a similar half dye-sensitized plate was studied separately, and has been found to be analogous to the action of wood. Such a plate when exposed to the vapour of hydrogen peroxide and processed in the usual way showed a distinctly lighter fog density in the regions bathed in the dye (Fig. 2). There is therefore a correlation between the action of wood and peroxide in this regard.

This experiment not only shows that some of the dyes used for sensitizing emulsions have a stabilising influence on the emulsion in the sense that they render it more resistant to the action of fogging agents such as wood and peroxide, but also lends support to the peroxide theory advanced by Russel<sup>1</sup> to account for the action produced by wood and other substances on photographic emulsions.

Dept. of Physics, V. P. NARAYANAN NAMBIYAR.  
Pachaiyappa's College,  
Madras-30, March 30, 1955.

1. Narayanan Nambiyar, V. P., *Curr. Sci.*, 1952, **21**, 182.
2. —, *Ibid.*, 1949, **18**, 284.
3. Russel, W. J., *Phil. Trans. of Roy Soc.*, London, 1905, **197B**, 281.
4. —, *Proc. Roy. Soc.*, 1898-99, **64**, 409.

#### UPPER LEVEL THERMAL TROUGHS AND LOWS IN THE DEVELOPMENT OF DUSTSTORMS AND THUNDER- STORMS OVER NORTH-WEST INDIA AND WESTERN PAKISTAN

In three recent issues<sup>1-3</sup> of this journal, Ramaswamy and Bose drew attention to the close association of upper level thermal troughs and lows in the development of Nor'westers in the pre-monsoon season, over North-East India and Eastern Pakistan. An attempt was made by the author to see if a similar association existed between such thermal systems and duststorm and thunderstorm activity over North-West India and Western Pakistan. For this purpose, a preliminary study has been made, in the manner of Ramaswamy and Bose, of partial thermal patterns at 500 mb. (700 ~ 500 mb.) and the associated weather, for all the days in the months of May 1947 and 1954. Though the period examined is small, the results are interesting and suggestive.

The following important points have been observed: (1) Westerly upper level thermal troughs of varying intensity occasionally moved

across Western Pakistan and North-West India, in an easterly direction. Sometimes two troughs were seen simultaneously affecting the area, one following the other. These thermal troughs appeared to move on the thermal charts more or less like westerly low pressure troughs on the stream line charts. (2) Some of the thermal troughs were marked and extended up to 300 mb. or more, the axis of the trough at a higher level being westwards of its position at a lower level. Such troughs were associated with large-scale development of duststorms and thunderstorms, if adequate incursion of moisture took place in the lower levels.<sup>3</sup> For example, widespread duststorms and thunderstorms accompanied with ground squalls broke out over North-West India on 11-5-1954, in association with a deep upper level thermal trough while in the absence of such a system, mainly fair weather prevailed on 2-5-1954 (except for a few thunderstorms over the Punjab-Kumaon Hills where a feeble thermal trough existed), though the lower level synoptic situation was similar in the two cases. (3) As the thermal system moved eastwards, the area of thunderstorm activity moved with them, there being, generally, a predominance of thunderstorm activity in the eastern half of the trough.<sup>3-5</sup> It was interesting to note that the spatial distribution of thunderstorm activity had a much closer association with the upper level thermal pattern than with the lower level stream line pattern. (4) The duststorm and thunderstorm activity was particularly marked in the afternoon, when insolation activated to the maximum, the upward impulses provided by the thermal trough.<sup>3</sup>

Ramaswamy and Bose have particularly emphasized the importance of the advection of cold air (in the layer 700 ~ 500 mb.) associated with the upper level thermal troughs and lows, and considered it a factor of great importance in the development of thunderstorm activity over North-East India and Eastern Pakistan. The author<sup>6</sup> has made a study of the radio-sonde temperature data of 8 years (1945-52) for an individual station in North-West India, viz., Delhi, and found that only on a small number of occasions, significant advection of cold air took place in the layer 700 ~ 500 mb., prior to the development of duststorms and squall type thunderstorms. During the period March-June when most of the duststorms and thunderstorms occur at Delhi, a fall of more than 3° C. took place on less than 30% of the occasions and a significant fall of more than 5° C. on less than 15% of the occasions. As Delhi can

be taken to be representative of North-West India, it would appear that most of the thermal troughs or lows which cause duststorms or thunderstorms over North-West India and Western Pakistan, have no exceptional coolness in the upper air and as such the dynamical rather than the thermal processes are of greater importance in the development of duststorms and thunderstorms over these areas.

A paper on the subject with full meteorological details is being sent for publication in the *Indian Journal of Meteorology and Geophysics*.

Meteorological Office, Y. P. R. BHALOTRA.  
Safdarjung Airport,  
Delhi-3, April 12, 1955.

1. Ramaswamy, C. and Bose, B. L. *Curr. Sci.*, 1953, 22, 103.
2. —, *Ibid.*, 1953, 22, 291.
3. —, *Ibid.*, 1954, 23, 75.
4. "Discussions on Cold Pools," *London Met. Magazine*, London Met. Office, 1953, 82 (969), 81.
5. Sutcliffe and Forsdyke, *Quart. J. Roy. Met. Soc.*, 1950, 76, 189.
6. Bhalotra, Y. P. R., *Ind. J. Met. Geophys.*, 1955, 6, 81.

#### DECAY OF THALLIUM $^{204}$

RECENTLY Yuasa *et al.*<sup>1</sup> have reported an analysis of the beta-spectrum of  $Tl^{204}$  using a magnetic lens beta-ray spectrometer and applying corrections due to (a) resolution of the spectrometer, (b) the screen effect, (c) absorption in the counter window, and (d) the type of beta-transition involving  $\Delta j = 2$ , yes. Even after applying these corrections the Fermi-plot was found to deviate from a straight line below about 200 Kev. This deviation has been explained to be due to a second beta-ray group having maximum energy at 400 Kev. From this Fermi-analysis they have estimated the intensity of this beta-ray group to be of the order of 5% of the total beta-ray intensity. This beta-ray group as naturally one expects, fits well as a transition between the ground state of  $Tl^{204}$  and the first excited state of  $Pb^{204}$ .

$Tl^{204}$  contains 81 protons, i.e., one proton less than required for completion of the 82 proton magic shell and 123 neutrons, i.e., three neutrons less in 126 neutron shell (magic number). From the shell model of the nucleus one expects the spin of  $Tl^{204}$  to be  $\leq 2$  and odd parity. Since  $Pb^{204}$  is an even-even nucleus, its spin is assumed to be zero and of even parity. The maximum energy of beta-ray transition from the ground state of  $Tl^{204}$  to  $Pb^{204}$  is re-

ported to be  $765 \pm 10$  Kev.<sup>1,3</sup>  $Bi^{204}$  (17 h. half life) decays<sup>4</sup> to 374 Kev. isomeric state, the first excited state of  $Pb^{204}$ , by electron capture; and then to the ground state by emitting a  $\gamma$ -ray of energy 374 Kev. From life-time and internal conversion coefficient measurements of this gamma ray, the spin of this state is determined to be 2 and of even parity, in good agreement with prediction of spin and parity of first excited level of even-even nuclei.<sup>5</sup> This means that a beta-ray transition from the ground state of  $Tl^{204}$  to 374 Kev. excited state of  $Pb^{204}$  is, energetically and from spin-parity change considerations, possible. ( $E_{\beta_2} = 400$  Kev.,  $\Delta j = 0$ , yes.). But no  $\gamma$ -ray of about 375 Kev. energy has been observed in the decay of  $Tl^{204}$ . This makes the complexity of the beta spectrum uncertain. Yuasa *et al.* have looked for this gamma-ray in the internal conversion electron spectrum and have reported that there is an indication of a line in the region 215 to 315 Kev. No line, however, corresponding to this energy was found in their scintillation spectrometer. Smith<sup>2</sup> from his scintillation spectrometer study of  $Tl^{204}$  has put an upper limit of  $10^{-4}$  per beta disintegration, for this gamma-ray transition.

Decay of  $Tl^{204}$  will be more interesting if additional information is collected on the complex nature of the beta-spectrum. With this view, a direct investigation for this gamma-ray and an estimation of its intensity has been made with the the Seigbahn-Slatis Beta-ray spectrometer by recording photo-electron spectrum.

Active  $Tl^{204}$  of 610  $\mu$ c. strength was spread over an area of 6 mm. diameter and was covered with aluminium sufficient in thickness to absorb all primary beta-particles. Over this a lead foil of 40 mg./cm.<sup>2</sup> thickness and  $\frac{3}{4}$ " diameter was placed. A very weak line was observed in the region 280 to 320 Kev. Counting rate near peak position was about 15 c.p.m. more than the background which was 16 c.p.m. Energy of the gamma-ray corresponding to this peak is  $380 \pm 15$  Kev. Since there is no other known gamma-ray line in this decay for comparison of intensity, an indirect method of comparison was adopted.

For comparison, the photo electron spectrum of 411 Mev. gamma-ray of  $Au^{108}$  was taken under exactly similar geometrical conditions as that of  $Tl^{204}$  to keep instrumental constant the same for both. The intensities of these sources were determined with the help of a calibrated source  $Tl^{210}$  of strength  $1.81 \times 10^{-2}$   $\mu$ c. and it was also verified by a direct counting method



in a standard geometrical arrangement. This geometry was in turn standardized by the calibrated sources  $\text{Bi}^{210}$ ,  $\text{Ux}_2^{234}$  and  $\text{C}^{14}$ . From (a) known strength of  $\text{Au}^{198}$  ( $9.1 \times 10^{-2} \mu\text{c.}$ ), (b) areas under the two photo-electron peaks observed and known decay scheme<sup>4</sup> of  $\text{Au}^{198}$ , the intensity of 375 Kev. gamma-ray in  $\text{Tl}^{204}$  was calculated and it is found to be  $(8 \pm 2) \times 10^{-5}$  per beta disintegration. This is in agreement with an upper limit put by Smith as  $10^{-4}$  per beta disintegration.  $\text{Au}^{198}$  source was chosen because its 0.411 Mev. gamma-ray is well established, its intensity is nearly 100%, the gamma-ray energy is very near to the energy of the gamma-ray under investigation, and the atomic number of gold is very near to that of Thallium. Strength of  $\text{Au}^{198}$  was such that the counting rate was of the same order as that for  $\text{Tl}^{204}$  source.  $\text{Au}^{198}$  was prepared by  $\text{Au}^{197}(\text{n}, \gamma) \text{Au}^{198}$  reaction in the cascade generator at this Institute.

My thanks are due to Dr. H. J. Bhabha, for his kind interest and to Dr. B. V. Thosar for helpful comments and suggestions during this work. I wish to thank Dr. R. Ramanna and the Cascade Generator Group, for their help with the irradiation of gold and Mr. S. D. Bhagwat for technical assistance.

Tata Institute of  
Fundamental Research,  
Bombay-1, May 6, 1955.

M. C. JOSHI.

1. Yuasa, T., Laberrigue-Frolow, J. and Feuvrais, L., *J. Phys. le Rad.*, 1955, **16**, 39.
2. Mateosian, E. D. and Smith, A., *Phys. Rev.*, 1952, **88**, 1186.
3. Lidofsky, L., Macklin, P. and Wu, C. S., *Ibid.*, 1952, **87**, 204 and 391.
4. Hollander, J. M., Perlman, I. and Seaborg, G. T., *Rev. Mod. Phys.*, 1953, **25**, 592 and 584.
5. Scharif-Goldhaber, G., *Phys. Rev.*, 1953, **90**, 587.

#### PHOTOELASTIC CONSTANTS OF THALLIUM ALUM

It has been reported earlier<sup>1</sup> from this laboratory that the photoelastic behaviour of thallium alum  $[\text{TlAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}]$  is exceptional in having a positive value of  $q_{44}$ , whereas all the other crystals belonging to the  $T_h$  class have a negative  $q_{44}$ . The individual photoelastic constants of this substance could not be determined, as the elastic constants were not known at that time. The elastic constants are now available<sup>2</sup> and its complete study is undertaken.

The localised fringe method<sup>3</sup> has been adopted to determine the individual photoelastic constants. The prism used is of dimensions

0.385 cm., parallel to  $[001]$ , 0.298 cm., parallel to  $[110]$  and 0.297 cm., parallel to  $[\bar{1}10]$ . The stress is applied along  $[001]$  and a set of localised fringes is obtained making the observation along  $[110]$ , the source of light being a sodium lamp. The loads for a shift of two complete fringes for vertically and horizontally vibrating beams of light are found to be 1320 and 1050 g. respectively, the mechanical advantage of load being 3.992. The refractive index is taken as 1.498.<sup>4</sup> The elastic constants<sup>2</sup> used are  $s_{11} = 49.0$ ,  $s_{12} = -15.5$ , and  $s_{44} = 114.8$ ,  $\times 10^{-13} \text{ cm}^2 \text{ dyne}^{-1}$ . Employing these data, we get

$$q_{11} = +6.4 \text{ and } \frac{1}{2}(q_{12} + q_{13}) = +11.6, \times 10^{-13} \text{ cm}^2 \text{ dyne}^{-1}$$

Combining these with the compensator observations reported earlier,<sup>1</sup> viz.,  $q_{11} - q_{12} = -5.72$ ,  $q_{11} - q_{13} = -4.65$ , and  $q_{44} = +0.81$ , we get  $q_{11} = +6.4$ ,  $q_{12} = +12.1$ , and  $q_{13} = +11.1$ ,  $\times 10^{-13} \text{ cm}^2 \text{ dyne}^{-1}$ . It can be seen that these values are of the same order of magnitude as for other alums.<sup>5</sup>

The axial tilts on the application of stress for various orientations are determined using a polarising microscope. The crystal prism, compressed by means of a small stressing frame, is kept on the stage of the microscope and the angle between the extinction positions and the edge of the prism parallel to the direction of stress is read on the circular scale. This method is found to be more convenient than the one used earlier.<sup>6</sup> There is good agreement between the observed and the calculated values. The angle of tilt obtained, when the stress is applied along  $[\bar{2}11]$  making the observation along  $[01\bar{1}]$ , is worth mentioning, as it is as large as  $33^\circ$ , whereas the value for other alums is about  $5^\circ$ . This is so on account of the positive sign of  $q_{44}$  for this crystal.

The authors wish to express their grateful thanks to Professor S. Bhagavantam for his keen interest in this investigation.

Physical Laboratories, K. V. KRISHNA RAO.  
Osmania University, (MISS) V. KALPAGAM.  
Hyderabad, May 21, 1955.

1. Bhagavantam, S. and Krishna Rao, K. V., *Curr. Sci.*, 1954, **23**, 257.
2. Subrahmanyam, S. V., *Thesis submitted to the Osmania University*, 1954.
3. Ramachandran, G. N., *Proc. Indian Acad. Sci.*, 1947, **25A**, 208.
4. *International Critical Tables*, 1926, **1**, 165.
5. Bhagavantam, S. and Suryanarayana, D., *Acta Cryst.*, 1949, **2**, 26.
6. Bhagavantam, S. and Krishna Rao, K. V., *Proc. Indian Acad. Sci.*, 1953, **37A**, 589.



# ESTIMATION AND COMPLEXES OF ZIRCONIUM WITH OXALATES

A METHOD of estimation<sup>1</sup> of zirconium consists in precipitation as oxalate, and ignition to  $ZrO_2$ . The present communication shows that the precipitation can be followed quantitatively by potentiometric measurements.

A. R. grade  $Zr(NO_3)_4$  was dissolved to form a 0.1 M solution. A given volume of the solution was taken in a Pyrex vessel, and the following cell formed:

$Hg | Hg_2Cl_2, KCl \text{ sat.} || KCl \text{ sat.} | Zr(NO_3)_4 | Pt$   
The e.m.f. (E) of the cell was determined against a 2-volt accumulator after successive additions of small amounts of a standard solution of  $Na_2C_2O_4$  from a burette, and thorough mixing. In Fig. 1 are shown a representative

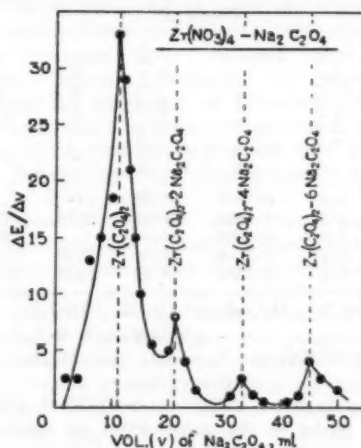


FIG. 1

set of plots of  $\Delta E/\Delta v$  against the corresponding volume (v), in ml., of the  $Na_2C_2O_4$  solution. Results with other soluble oxalates and oxalic acid, and at various concentrations, were similar.

The curve in Fig. 1 shows four well-defined peaks corresponding respectively to quantitative precipitation of zirconium as  $Zr(C_2O_4)_2$  and three oxalate complexes in which zirconium is associated with 4, 6 and 8 oxalate ions. The formation of the first complex is accompanied by complete dissolution of the precipitated  $Zr(C_2O_4)_2$ .

Grateful thanks of the authors are due to Prof. S. S. Joshi for his kind interest in the work.

Electro-Chem. Lab., S. R. MOHANTY.

Banaras Hindu

D. SINGH.

University,

J. GOPALA KRISHNA MURTY.

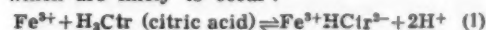
February 27, 1955.

I. Hopkins, B. S., *Chapters in the Chemistry of the Less Familiar Elements*, Stipes Publishing Co., Illinois, 1939, 2, p. 16.

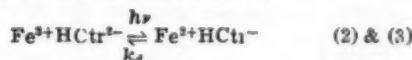
## CITRATE RADICAL-ION POLYMERIZATION OF METHYL METHACRYLATE

FOLLOWING the work of Evans and Uri,<sup>1</sup> a detailed investigation of the polymerization of vinyl monomers with the ion-pair complexes of the type  $Fe^{3+}X^-$  where  $X^-$  = hydroxyl, chloride and azide has been carried out by Evans, Santhappa and Uri.<sup>2</sup> Some of the results obtained in the polymerization of methyl methacrylate with the ferric citrate complex ( $Fe^{3+}HCtr^{2-}$ ) irradiated at 365 mμ are reported here. The studies have been confined to a pH range of 0.5 to 0.7 in which the concentration of the active ion-pair  $FeOH^{2+}$  is minimal and therefore ferric citrate complex is the only active sensitizer.

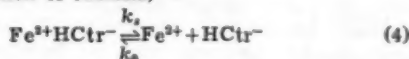
The following scheme contains reactions which are likely to occur:



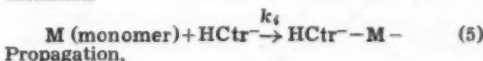
Irradiation and electron transfer,



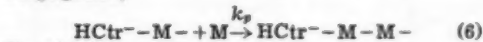
Production of radicals,



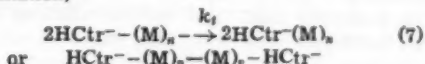
Initiation



Propagation,



Termination,



Assuming stationary concentrations for free radicals and free radical chains it is easy to obtain the following expressions for quantum yield with regard to ferrous ion production  $\gamma_{\text{net}}$ , the rate of monomer disappearance  $-dM/dt$  and the degree of polymerization,  $P_n$ . These expressions may be considered for testing how far the scheme given above is applicable to the system under investigation.

$$\gamma_{\text{net}} = [k_i / (k_i + k_a)] [k_i [M]] / (k_a [Fe^{2+}] + k_i [M]) \quad (8)$$

$$-dM/dt = (k_p / k_i^{1/2}) [k_i k_a I / (k_a + k_i)] [M] \quad (9)$$

$$P_n = (-dM/dt) / (1/2)(dFe^{2+}/dt) \text{ for termination by combination} \quad (10)$$

$$= (-dM/dt) / (dFe^{2+}/dt) \text{ for termination by disproportionation} \quad (11)$$

Determination of  $-dM/dt$  were made by the familiar method of weighing the purified and dried polymers and degrees of polymerization were determined by measuring the viscosities of dilute solutions of polymers in benzene.<sup>3</sup> Quantum yield for ferrous ion production  $\gamma_{\text{net}}$  was obtained by measuring the rate of ferrous ion production colorimetrically with 0-0' phenanthroline. The intensity of light I was determined actinometrically and  $k_e$ , the light absorption fraction for the ion-pair  $\text{Fe}^{3+} \text{HCTr}^{2-}$  was determined from a knowledge of the molar extinction coefficient of the ion-pair and the equilibrium constant for its formation.

The equilibrium constant for the formation of ferric citrate complex (step 1 in the scheme above) was evaluated by measuring in a Beckman Spectrophotometer (Model D.U.) the optical density of the system containing the species  $\text{Fe}^{3+}$ ,  $\text{FeOH}^{++}$ ,  $\text{FeHCTr}^{+}$ ,  $\text{H}_3\text{Citr}$ ,  $\text{FeSCN}^{++}$  at 525  $m\mu$  at which all the species except  $\text{FeSCN}^{++}$  have negligible absorption. The molar extinction coefficient curve obtained for the species  $\text{FeSCN}^{++}$  (Fig. 1, A) differed

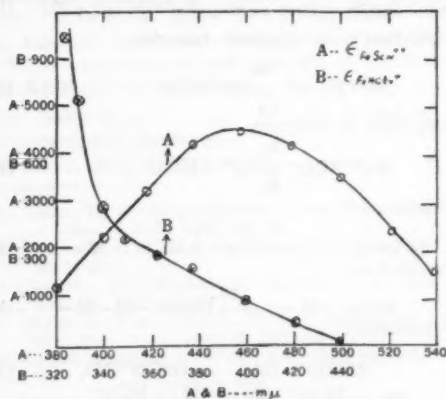


FIG. 1

slightly from that by Frank and Oswalt<sup>4</sup> who also obtained a value  $\epsilon = 1875$  at 525  $m\mu$  and a mean value of 136.2 for the equilibrium constant for the formation of  $\text{FeSCN}^{++}$ . The values obtained for these by us were 2200 and 137.4 respectively. A mean value of 1.2 was obtained for the equilibrium constant for the formation of ferric citrate complex at ionic strength 1.0. Though this differed largely from that by the earlier workers,<sup>5</sup> yet the value of  $k_e$  which is concerned in the work is relatively unaffected.

When the system  $\text{FeHCTr}^{+}$  methylmethacrylate in aqueous solution is deaerated and irradiated with ultraviolet light of wavelength

larger than 300  $m\mu$ , polymerization was noticed within almost one minute. Wavelengths as high as 400  $m\mu$  were found to be effective although 365  $m\mu$  was used in our experiments. The results with different concentrations of methylmethacrylate monomer are given in Table I.

There is a small variation in quantum yield for ferrous ion production (0.13 to 0.15) as the monomer concentration varies from 0.14 to 0.04 molar. The molecular weight averages of unfractionated polymethylmethacrylate polymers ranged from ca. 200,000 to 600,000. The discrepancy between calculated and measured degrees of polymerization decreases as the monomer concentration is increased. It is concluded that  $\text{FeHCTr}^{+}$  as an initiator is of

TABLE I

[M] (molar)	$d\text{Fe}^{2+}/dt$ (moles/hr.) $\times 10^3$	$\gamma_{\text{net}}$	$-dM/dt$ (moles/hr.) $\times 10^3$	$P_n$ measured	$P_n$ calculated
0.04	3.4	0.1557	3.81	..	..
0.08	3.2	0.1468	11.43	2556	713
0.094	3.9	0.1803	16.0	..	812
0.12	3.07	0.1408	16.5	3530	1519
0.14	3.0	0.1374	16.92	6457	1128

$[\text{Fe}^{3+}] = 10^{-3}\text{M}$ ;  $[\text{H}_3\text{Citr}] = 5 \times 10^{-3}\text{M}$ ;  $[\text{HNO}_3]$

$= 0.19\text{M}$ ;  $\text{pH} = 0.7$ ;  $\mu = 0.2$

$I = 5.08 \times 10^{-5}\text{Nh}\nu/\text{hr}$ ;  $k_e = 0.43$ ; [M] = Methylmethacrylate

the same type as  $\text{FeCl}^{++}$  and  $\text{FeOH}^{++}$  and it appears to be of the same order of reactivity as  $\text{FeCl}^{++}$  with which the quantum yield for ferrous was 0.13. The small variation of  $\gamma_{\text{net}}$  with change in monomer concentration and the difference in measured and calculated  $P_n$  are to be traced partly to reactions of the radicals with the other unrecognised species in the system as has been already reported<sup>2</sup> with  $\text{FeOH}^{++}$  and  $\text{FeCl}^{++}$  initiators.

A detailed account will be published elsewhere.

Univ. Phys. Chem. Labs., R. V. SUBRAMANYAN.  
Madras-25, April 23, 1955. M. SANTHAPPA.

1. Evans, M. G. and Uri, N., *Nature*, 1949, **164**, 404.
2. —, M. G., Santhappa, M. and Uri, N., *J. of Poly. Sci.*, 1951, **7**, 243.
3. Baxendale, J. H., Bywater, S. and Evans, M. G., *Ibid.*, 1946, **1**, 237.
4. Frank, H. S. and Oswalt, R. L., *J. Am. Chem. Soc.*, 1947, **69**, 1321.
5. Lanford, O. E. and Quinan, J. R., *Ibid.*, 1948, **70**, 2900.

# GLACIATION IN THE VINDHYAN SYSTEM\*

THE author, accompanied by Mr. G. C. Taylor (of the U.S.G.S. now with the G.S.I.) and Dr. B. P. Tewari (Director of Industries, V.P., formerly of the G.S.I.), discovered a distinct tillite below the Pandava Falls, about 7 miles from Panna, on the Chattarpur Road. It contains large erratics in a fine matrix, and there is no evidence of sorting or bedding. It is, however, overlain by a conglomerate which passes upwards into what are considered to be varvites. Mallet<sup>4</sup> has mapped the area as belonging to the Kaimur Series, and this is apparently correct. There can be no doubt that the tillite belongs to the Vindhyan System.

The Shahidan Mines were also examined and it was felt that the thinly-bedded shales could be varvites. The intricate local folding was, perhaps, induced by moving ice during an extension of glaciation. This concept envisages a tillite younger than the shales, and it is, perhaps, significant that Sinor<sup>6</sup> described an overlying conglomerate which could be of glacial origin.

These discoveries open two possibilities, firstly, that the Gangau tillite, originally reported by Dubey and Chowdhury<sup>3</sup> as of basal Vindhyan, but later described separately by Chowdhury<sup>2</sup> and Mathur<sup>5</sup> as Bijawar, may yet be of Vindhyan age. The presence in it of jasper pebbles, and the occurrence of passage beds above them, as reported by Ahmad and Narain<sup>1</sup> recently, is hardly reconcilable with Bijawar age. And secondly that the Hindoun, Karauli and other breccias reported from the Vindhyan System by earlier workers may all have a glacial origin. The confusion about their origin is, thus, likely to be resolved.

This envisages persistent and repeated glaciation in the Cambrian of Central India.

Geol. Survey of India,  
Calcutta-13, November 15, 1954.

F. AHMAD.

\* Published with the kind permission of the Director, Geol. Survey of India,

1. Ahmad, F. and Narain, K., *Geol. Surv. of Ind. MS. Report*, 1954, p. 1.
2. Chowdhury, M. S., *Proc. 40th Ind. Sc. Cong.*, Abstract, Part 3, 1953, p. 20.
3. Dubey, V. S. and Chowdhury, M. S., *Curr. Sci.*, 1952, 21, 331.
4. Mallet, F. R., *Mem. G.S.I.*, 1871, 7, Plate 1.
5. Mathur, S. M., *Curr. Sci.*, 1954, 23, 7.
6. Sinor, K. P., *The Panna Diamond Mines*, 1930, p. 17 and Figs. 2 and 5.

# EFFECT OF DEFICIENCY OF RIBOFLAVIN AND NICOTINIC ACID ON THE SYNTHESIS OF ACETYL CHOLINE IN RATS

IN our previous investigation<sup>1</sup> on the biosynthesis of acetyl choline in rat tissues, it was reported that individual deficiency of thiamine and pantothenic acid in the diet produces a great decrease in the acetyl choline content of liver, brain and heart tissues, thus supporting the concept that both these vitamins are involved in the synthesis of acetyl choline—thiamine as co-carboxylase and pantothenic acid as coenzyme A in forming acetyl group necessary for acetylation of choline by phosphoroclastic split of pyruvic acid into acetyl-phosphate through the intermediate of acetyl COA complex.<sup>2,5,7</sup>

In view of nicotinic acid and riboflavin constituting and functioning as cofactors of various dehydrogenase systems in the body,<sup>3,4</sup> it was thought that deficiency of these two vitamins may influence the acetylcholine synthesis in rat tissues. The investigations were conducted on four groups of ten young male rats of 40-50 g. body-weight each kept on a synthetic diet of the following composition: starch—52%, casein—20%, sugar—15%, salt mixture (McCullum and Davis)—4%, ghee—6%, cod liver oil—2%, vitamin mixture—1%. The composition of the vitamin mixture was the same as reported in our previous investigation.<sup>1</sup> Group I was kept on synthetic diet with all the vitamin supplements but in Groups II, III and IV, nicotinic acid, riboflavin and thiamine were omitted respectively from the vitamin mixture. The rats were fed *ad libidum* for a period of 6-8 weeks till the deficiency symptoms were produced. They were then sacrificed and the heart, brain and liver were removed and the tissues minced and ground in eserinated tyrode solution and centrifuged. The supernatant tissue extracts were assayed for acetyl choline content according to the method previously described.<sup>1</sup> The response of a small and a high dose of each extract was tested and the average acetyl choline content of the tissues were then calculated by comparison against the standard. The result are presented in Table I.

From the results it is evident that deficiency of nicotinic acid and riboflavin effects a significant and almost similar decrease in acetylcholine content of heart, brain and liver tissues. Thiamine deficiency produces much greater decrease than the deficiencies of nico-

TABLE I

Showing the average acetyl choline content per gram of tissues and percentage reduction in deficient groups of rats

Tissues		Control Group I	Nicotinic acid-deficient Group II		Riboflavin-deficient Group III		Thiamine-deficient Group IV	
		Acetyl choline µg./g.	Acetyl choline µg./g.	Reduction as compared to control	Acetyl choline µg./g.	Reduction as compared to control	Acetyl choline µg./g.	Reduction as compared to control
Heart	..	4.73	2.88	41.6%	2.6	45.06%	1.208	74.46%
Brain	..	2.46	1.61	34.5%	1.75	29.86%	0.50	79.6%
Liver	..	2.376	0.24	89.5%	0.32	86.5%	0.125	94.7%

tinic acid and riboflavin. This suggests that thiamine is primarily involved in the biosynthesis of acetyl choline, because of its main function in the production of acetyl groups from pyruvic acid by participating as diphosphothiamine in the first of the chain of reactions, i.e., decarboxylation of pyruvic acid to acetaldehyde COA complex in presence of COA as postulated by Korkes *et al.*<sup>3</sup> and Ochoa and Stern.<sup>6</sup> Further, the higher percentage of decrease of acetyl choline in case of liver tissue in all the deficient groups suggest that this tissue may primarily be responsible for the large part of biosynthesis of acetyl choline in body.

Dept. of Pharmacology,  
M. G. M. Medical College,  
Indore, M.B.,  
March 29, 1955.

B. C. BOSE.  
S. S. GUPTA.  
H. N. DE.

1. Bose, B. C., Gupta, S. S. and De, H. N., *Curr. Sci.*, 1954, **23**, 122.
2. Chantrenne, H. and Lipmann, F., *Biol. Chem.*, 1950, **187**, 757.
3. Korkes, S., del Campillo, A., Gunsalus, I. C. and Ochoa, S., *Ibid.*, 1951, **193**, 721.
4. —, S. Stern, J. R., Gunsalus, I. C. and Ochoa, S., *Nature*, **166**, 439.
5. Lynen, F. and Reichert, E., *Angew. Chem.*, 1951, **63**, 47.
6. Ochoa, S. and Stren, J. R., *Ann. Rev. Biochem.*, 1952, **21**, 567.
7. Stadman, E. R., *Fed. Proc.*, 1950, **9**, 233.

#### THE BASIS OF STARLING'S LAW OF THE HEART

STARLING found that the force of contraction of the heart increases with the length of the fibres composing its walls. The question arises whether this property of the heart is due to

changes in the membrane, that is, the excitatory system, or the contractile mechanism.

In unstriated muscle, the excitatory system can be destroyed by heating for 10 minutes at 50° C. (Singh and Singh<sup>1-3</sup>). This preparation is relaxed actively by heat and some chemicals that cause denaturation of proteins. As denaturation is presumed to be accompanied by unfolding of the polypeptide chains, this shows that relaxation of muscle is due to unfolding of the polypeptide chains, and provides indirect evidence of chain-folding during contraction. The heat-killed muscle is made to contract by some protein coagulants, and the responses thus produced resemble the responses of the living muscle very closely, thus indicating that the normal contractile process in muscle resembles the coagulation of proteins (Singh and Singh<sup>4,5</sup>).

The heat-killed muscle is made to contract by hydrochloric acid solution and by heating to 70° C. Striated and unstriated muscles give powerful contractions, and the latter shows more forcible contraction with increase in length up to a certain extent. In heart muscle it is difficult to obtain a piece with parallel fibres, so the contraction is not so powerful. To show Starling's law on the heat-killed heart muscle, transverse pieces of the right ventricle of the dog's heart are used; the whole of the frog's heart can be suspended like an ordinary piece of unstriated muscle. In heart muscle, the heat contraction is partially reversible, so that a tonic contraction persists after the first heating to 70° C.; but on this tonic contraction, reversible contractions can be superimposed. These contractions can be used to study the properties of the contractile mechanism of the heart muscle.

The heat-killed heart muscle shows Starling's law of the heart (Fig. 1). These experiments

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show that the basis of the law is some change in the proteins of the muscle, which respond

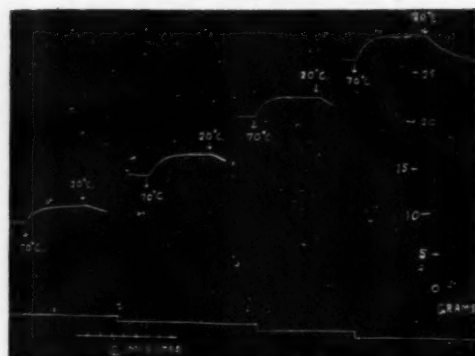


FIG. 1. Frog's heart killed by heating to 50° C. (*Rana tigrina*). Effect of stretching on the tension produced by heating to 70° C. Note that the last contraction is about double the first. The length was increased by 3-4 per cent. each time.

by more forcible contraction, if they are stretched.

Dept. of Physiology, SUNITA INDERJIT SINGH.  
Medical College, INDERJIT SINGH.  
Agra, April 11, 1955.

1. Singh, S. I. and Singh, I., *Curr. Sci.*, 1954, **23**, 126.
2. —, *Proc. Ind. Acad. Sci.*, 1954, **39**, 125.
3. —, *Ibid.*, 1954, **40**, 145.
4. —, *Ibid.*, 1955, **51**, 47.
5. —, *Ibid.*, 1955, **51**, 173.

#### DISTRIBUTION OF RADIOACTIVITY IN THE KHONDALITES OF ANDHRA STATE

KHONDALITE series are extensively developed in the Eastern Ghats. A typical khondalite essentially consists of quartz, felspar, garnet, sillimanite and graphite with magnetite, apatite and rutile as accessories. Khondalites are intruded by charnockites and pegmatites resulting in the development of a complex group of interaction rocks. Beta-activity was determined, according to a method earlier outlined,<sup>1</sup> for 36 specimens of khondalites drawn from Krishna, Godavari, Visakhapatnam and Srikakulam Districts (16° 30' E to 19° 30' E and 80° 36' to 83° 42') of Andhra State.

The radioactivity data on khondalites are studied from three mutually-related aspects—

- (i) mineralogical constitution and radioactivity,
- (ii) associational characteristics and radioactivity, and
- (iii) radioactivity and petrogenesis.

(i) It is found that an increase in the radioactive content can be correlated to an increase in the total content of garnet and sillimanite and a decrease in the content of quartz. It appears that the high radioactivity in khondalites is associated with heavy minerals—mostly garnets and sillimanite, which is supported by the correlation between the radioactive content of and the percentage of heavy minerals in the khondalites (Table I).

TABLE I  
Heavy mineral content and radioactivity

Specimen No.	Percentage of heavy minerals in the rock	Radioactive content (in ppm. of U)
2	73.38	12.86
7	60.72	8.72
21	43.57	4.00

As can be expected,<sup>1</sup> specimens of khondalites which bear evidences of later felspathisation are characterised by a higher radioactivity than the non-felspathised ones.

(ii) The mode of association of khondalites seems to have a profound influence on the distribution of radioactivity in the rocks. While the association of khondalites with pegmatites, charnockites and interaction rocks seems to enhance the radioactivity of the former, occurrence in the proximity of calc-granulites, quartzites and quartz-veins appears to depress it (Table II).

TABLE II  
Associational characteristics and radioactivity of khondalites

Nature of association	Number of specimens examined	Mean radioactive content (in ppm. of U)
Pegmatites	2	16.96
Charnockites	4	10.50
Interaction rocks	8	10.41
Calc-granulites	2	7.94
Quartzites and quartz veins	6	7.11

(iii) The high radioactivity of khondalites (9.32 ppm. of U) is visualised as a



manifestation of either or both of the two processes: hypo-metamorphism, and adsorption of radioactive matter in the colloidal phase. Khondalites were subjected to hypo-metamorphism<sup>2</sup> and it is possible that the extreme conditions of temperature and pressure under which such a process took place, might have facilitated the dissemination of radioactive matter into the khondalites.<sup>3</sup> Alternately, it can be surmised that the colloidal clayey and organic components of khondalites were instrumental in chemically adsorbing uranium from ocean waters at the time of deposition.<sup>4-6</sup> Of the two possibilities, the second one is more probable, but it cannot be ruled out that both might have participated to bring about the present distribution of radioactivity in khondalites.

It is suggested that radiometric work in areas where khondalites are rich in argillaceous and carbonaceous components may bring to light significant sources of uranium.

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Geology Dept.,  
Andhra University,  
Waltair,

C. MAHADEVAN.  
A. V. R. SASTRY.  
U. ASWATHANARAYANA.

April 14, 1955.

1. Aswathanarayana, U., *J. Sci. Ind. Res.*, 1954, **13B**, 87.
2. Fennor, L. L., *Records Geol. Surv. Ind.*, 1936, **70**, 24.
3. Ramberg H., *Origin of Metamorphic and Metasomatic Rocks*, 1952, Chicago University Press, 201.
4. Beers, R. F., and Goodman, C., *Bull. Geol. Soc. Amer.*, 1944, **55**, 1229.
5. Beers, R. F., *Bull. Amer. Assm. Petroleum Geologists*, 1945, **29**, 11.
6. McKelvey, V. E. and Nelson, J. M., *Econ. Geol.*, 1950, **45**, 35.

#### EFFECT OF IONIC SIZE, CHARGE AND VALENCY ON DONNAN DIFFUSION IN CATION-EXCHANGE MEMBRANE

In a previous publication<sup>1</sup> the variation in chloride uptake by two samples of cation-exchange membranes in hydrochloric acid, sodium chloride and barium chloride solutions was reported. This note describes the results obtained with Nepton CR-51 cation-exchange membrane in different salt solutions.

The membrane was converted to the different salt forms for determining the amount of chloride absorbed by the Donnan diffusion process. The determinations were carried out in a manner similar to that reported earlier.<sup>2</sup>

In Fig. 1, the ratio of the amount of chloride absorbed by the membrane ( $N_A$ ) to the external chloride concentration  $N_A/N_{EXT}$  is plotted

RELATIONSHIP BETWEEN  $\frac{N_A}{N_{EXT}}$  VS  $N_{EXT}$  FOR NEPTON CR-51 WITH DIFFERENT ALKALI AND ALKALINE EARTH CHLORIDES

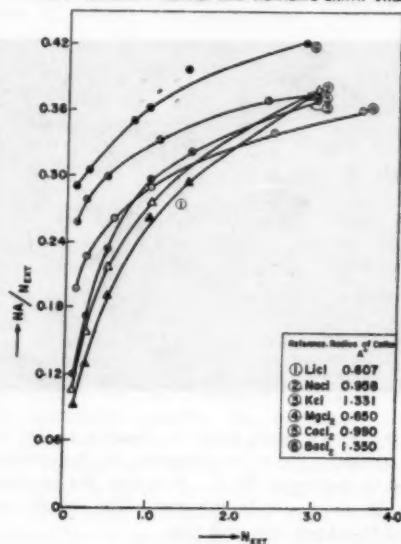


FIG. 1

against the external chloride concentration ( $N_{EXT}$ ). The results reveal that among the divalent alkaline earth salts the uptake of chloride is highest with barium chloride (cation radius 1.35 Å) and lowest with magnesium chloride (cation radius 0.65 Å). Similarly, among the alkali salts reported in this note, the uptake of chloride is found to be highest with potassium chloride (cation radius 1.33 Å) and lowest with lithium chloride (cation radius 0.607 Å). The effect of charge and valency of the cation on the chloride uptake by the cation exchange membrane is revealed by the difference in the amount of anion absorbed when using barium chloride (divalent and of ionic radius 1.35 Å) and potassium chloride (monovalent and of ionic radius 1.33 Å) solutions. Thus, the quantity of anion diffusing into the cation-exchange membrane is seen to depend on the ionic radius of the cation, and among cations of almost similar ionic radii their charge and valency govern the quantity of anion diffusing into the membrane.

Full details of the work will be published elsewhere.

National Chemical  
Laboratory of India,  
Poona-8, April 1, 1954.

N. KRISHNASWAMY.

1. Krishnaswamy, N., *J. Phys. Chem.*, 1955, **59**, 187.
2. —, *J. Sci. Industr. Res. (India)*, 1954, **13B**, 722.

# PAPER CHROMATOGRAPHY AND RADIOAUTOGRAPHY OF AMYLASE

HOKIN AND HOKIN<sup>1</sup> have shown that a correlation exists between uptake of radioactive phosphorus ( $P^{32}$ ) into the phospholipids and amylase synthesis in pigeon pancreas slices. Factors which stimulated or inhibited amylase synthesis also had a similar effect on uptake of  $P^{32}$  by phospholipids. Fischer and Bernfeld<sup>2</sup> have found that inositol phospholipid accompanies amylase during the purification of the enzyme. Recently we have provided evidence which indicates that inositol is involved in the activity of amylase<sup>3</sup> in confirmation of earlier evidence to that effect.<sup>4</sup> In order to provide additional evidence for this function of inositol and in the light of the above observations, it was thought of interest to determine if the amylase synthesised by pigeon pancreas slices *in vitro* is secreted into the incubation medium as the enzyme-phospholipid complex or lipoprotein. Bernfeld *et al.*<sup>5</sup> have concluded from molecular weight determinations of crystalline pancreatic amylases of different animal species that the enzyme protein is free of phosphorus. It was, therefore, thought that if the amylase is secreted into the medium as enzyme-phospholipid complex the enzyme thus secreted would be radioactive. In order to test this possibility paper chromatography and radioautography of the amylase synthesised and secreted into the incubation medium by pigeon pancreas slices in presence of radioactive phosphate has been carried out.

Pigeon pancreas slices were incubated for 2 hrs. at 37° C. in sheep serum (inactivated by heating at 60° C. for 2 hrs.) in Warburg flasks in an atmosphere of 95% oxygen 5% carbon dioxide. Fifty  $\mu$ c. of radioactive phosphate ( $P^{32}$ ) were added to each flask at the start of the incubation period. At the end of 2 hrs., the slices were removed from the flasks and ground up with sand and water. Aliquots of the enzyme extract and of the incubation medium were passed through Amberlite IRA-400 to remove the added inorganic phosphate and were then spotted on a line near one end of a filter-paper sheet. The technique of ascending chromatography was employed and the development was carried out at 0°-5° C. in view of the instability of the enzyme at higher temperatures. As developing solvents (i) 50% acetone,<sup>6</sup> and (ii) 10% ammonium sulphate<sup>7</sup> were employed and these gave good separation between the enzyme and the added inorganic phosphate. For the detection of the amylase

spots the technique of Giri *et al.*<sup>8</sup> was employed. The Rf values of the amylase in the above two solvents were respectively 0.42 and 0.31. For detection of radioactive spots, radioautography was employed. For this the developed chromatogram was placed in contact with an ILFEX X-ray film for 72 hrs. and the film was subsequently developed. The radioactive spots showed up as dark spots on the negative film and coincided with the positions of the amylase and inorganic phosphate on the chromatogram. The results obtained thus showed the presence of radioactive phosphorus in the amylase synthesised and secreted into the medium. As the radioactive phosphorus in the amylase is not removed on passing through the Amberlite resin, it is not inorganic in nature. Also, spraying the developed chromatogram with the phosphate reagent of Fiske and Subbarow<sup>8</sup> indicated the absence of inorganic phosphate in the position of the amylase spots. This finding, in conjunction with that of Bernfeld *et al.*,<sup>5</sup> indicates that the radioactive phosphorus is probably present as the phospholipid and the amylase itself is synthesised and secreted as the enzyme-phospholipid complex.

The authors wish to express their gratitude to the Indian Council of Medical Research for financial assistance.

University Biochem.

Laboratory,

Madras-25, April 21, 1955.

S. RAMACHANDRAN.

P. S. SARMA.

1. Hokin, M. R. and Hokin, L. E., *J. Biol. Chem.*, 1953, **203**, 967.
2. Fischer, E. H. and Bernfeld, P., *Helv. Chim. Act.*, 1948, **31**, 1839.
3. Ramachandran, S. and Sarma, P. S., *Ind. J. Med. Res.*, 1954, **42** (2), 201.
4. Lane, R. L. and Williams, R. J., *Arch. Biochem.*, 1948, **19**, 329.
5. Bernfeld, P., *Advances in Enzymology*, 1951, **12**, 396.
6. Giri, K. V., Prasad, A. L. N., Gouri Devi, S. and Sri Ram, J., *Biochem. J.*, 1952, **51**, 123.
7. Simonart, P. and Yu Chow, K., *Enzymologia*, 1950, **14**, 356.
8. Fiske, H. C. and Subbarow, Y., *J. Biol. Chem.*, 1925, **66**, 375.

## TAMARIND SEED POLYSACCHARIDES

In earlier communications Savur and Sreenivasan<sup>1-3</sup> have conclusively shown that tamarind seed polyose differs fundamentally from fruit pectins in its behaviour and chemical make-up. Hitherto tamarind seed meal had been known to contain only one type of polyose. How-

ever, the present investigation reveals that tamarind kernel powder contains three distinct types of fractions, which differ in their solubility and power of gelatinization and therefore they have been designated as fractions  $P_1$ ,  $P_2$  and  $P_3$ . Fraction  $P_1$  is soluble in water within 2-3 minutes at 5° C. and the yield varies from 2-4%; fraction  $P_2$  is soluble at room temperature when the seed meal is vigorously stirred with ten times its weight of water for about 45 minutes, the yield being 20-30%; while, fraction  $P_3$  is insoluble in cold water, but is completely soluble on boiling for 20 minutes, and the yield varies from 30-35%. Fraction  $P_1$  has no jellying property, while polyoses  $P_2$  and  $P_3$  have excellent jellying and sizing properties. The polysaccharides can be separated by: (1) Dialysis; (2) Partial hydrolysis with dilute acids; (3) Fractional precipitation with alcohol from warm water solutions; (4) Fractional precipitation with ammonium sulphate; and (5) Separation by electrostatic precipitation has only been partially successful. Therefore the assumption of Rao and White<sup>4</sup> that the tamarind kernel powder contains only one single polysaccharide is rather doubtful.

During recent years tamarind kernel powder has attained considerable commercial importance primarily as a sizing material due to its approximately 46-48% polyose content, but its application in industry has been limited in view of the fact that tamarind seed meal is invariably associated with about 52-54% of non-polyose materials such as testa particles, proteins, oils and fats, crude fibres, mineral matter, hemicelluloses, oligosaccharides, etc. Tamarind seed polysaccharides, mixture of  $P_2$  and  $P_3$  find extensive application in textile industry for sizing purposes, finishing and printing of cotton and artificial silk<sup>5</sup> and it also finds great scope in food industries.<sup>6</sup> It can be used as a substitute of cereal gums in rubber industry, plastic industry, paper industry, cardboard manufacture, triply wood industry, pharmaceutical and fine chemical industry, cosmetics and various other industries. A plant for manufacturing tamarind seed polyose has gone into operation in Bombay by a process patented by the author.<sup>7</sup> The process involves the bringing of the non-polyose materials and fraction  $P_1$  from tamarind kernel powder into a homogeneous aqueous solution at room temperature without causing gelatinization and without the application of heat, while the polyoses  $P_2$  and  $P_3$  are maintained in an insoluble state, where-

upon the two components are separated by dilution and by dialysis.

The Pectin Manfg. Co. Labs., G. R. SAVUR.  
Bombay-40, March 7, 1955.

1. Savur, G. R. and Sreenivasan, A., *Curr. Sci.*, 1945, **14**, 129; *Ibid.*, 1946, **15**, 43; *Ibid.*, 1946, **15**, 134; *Ibid.*, 1946, **15**, 168.
2. —, *J. Biol. Chem.*, 1948, **178**, 501.
3. —, *J. Soc. Chem. Ind.*, 1948, **67**, 190.
4. Rao, P. S. and White, E. V., *J. Amer. Chem. Soc.*, 1953, **75**, 2617.
5. Savur, G. R., *Indian Textile Journal*, 1955, **65**, 418.
6. —, *Indian Food Packer*, 1955, **9**, 13, 31.
7. —, Indian Patent No. 53429, dated December 27th, 1954.

#### EXPERIMENTAL INFECTION OF INDIAN MAJOR CARPS WITH *ICHTHYOPHTHIRIUS MULTIFILIS* FOUQUET\*

In the middle of March 1955 a local aquarist Shri G. Malik reported a heavy mortality of young *Xiphophorus hellerii* in his aquaria. The infected fishes were having white spots on their body which on examination were found to be due to a protozoan *Ichthyophthirius multifiliis* Fouquet. The aquarist was advised to change the water in the aquaria and give repeated baths to the fishes in 3% salt solution and also put as much salt in the aquarium as the fishes could tolerate. After 3 days the mortality was reduced considerably.

The infected fishes were put in a glass trough containing 14 litres of water along with two specimens each of *Labeo bata* (8 cm.) and *Cirrhina mrigala* (8 cm. and 8.5 cm. long). The carps were found infected after 3 days. Details are given below:

- 21-3-1955 Infected fishes introduced with carps.
- 24-3-1955 White spots appeared on the body of carps.
- 26-3-1955 White spots increased in size, parasite came out of a cyst on the body.
- 28-3-1955 White spots disappeared from the body of fish.

The temperature of the water varied between 28-30° C. and pH 7.6-8.4.

The above experiment shows that the Indian major carps are susceptible to infection by *Ichthyophthirius*, and under favourable conditions there is every chance of the parasite becoming a pest in the nursery ponds where the fishes are crowded and the water is stagnant; the two prime factors favouring its infection.

This parasite has proved very harmful in the hatcheries and aquaria in Europe, America, Australia, Tasmania and Japan. It is understood that in the fish ponds in Central China this parasite is found to infect the Chinese carps and it is controlled there by the application of 0.5 parts per million of copper sulphate to the pond water.

The life-history, infection and control of this parasite have been studied by Plehn,<sup>1</sup> Davis,<sup>2</sup> Butcher,<sup>3</sup> Barthélémy<sup>4</sup> and Prytherch.<sup>5</sup> The period of quarantine according to these authors varies from a week to a fortnight depending on the temperature of the water. In India, quarantine for one week will suffice to show the infection.

It may be pointed out here that the water from the infected aquaria should be sterilised either with formalin or creosote oil before being thrown out, and the dead infected fishes similarly treated. This disease seems to be new to India as there is no previous record of its infection. Every care should be taken not to introduce new diseases and parasites along with the imported fishes which may become an established menace to our fish farmers.

Central Inland Fisheries Y. R. TRIPATHI.  
Research Station,  
Calcutta-7, May 5, 1955.

\* Published with the permission of the Chief Research Officer.

1. Plehn, M., *Praktikum der Fischkrankheiten*, Stuttgart, 1924, p. 62.
2. Davis, H. S., *Care and Disease of Trout*, Research Report 12, U.S. Fish and Wild Life Service, 1947, p. 41.
3. Butcher, A. D., *Proc. Roy. Soc. Victoria*, 1948, 53, 126.
4. Barthélémy, H., *Ann. Parasitol. hum et. Compar.*, 1926, 4, 49.
5. Prytherch, H. F., *U.S. Dept. of Commerce, Bureau of Fisheries*, Document No. 959, 1924, pp. 1-6.

#### INHERITANCE OF A NEW TYPE LEAF IN RAPE

The leaves of the Yellow Sarson plants are of the typical lyrate form as shown in Fig. 1 (extreme left). The lyrate form is characterised by the presence of a broad terminal lobe with an obovate apex. The incisions in the normal type of leaves of Yellow Sarson almost touch the midrib and the lobes are somewhat perpendicular to the midrib. In the lower half of the leaf the lamina is represented only by a very narrow streak along the midrib and the lobes are separated from each other with an

indistinct sort of lamina in between the lobes. During 1952-53, a plant bearing a new type of leaves was found. The leaves borne by this plant were quite different from other varieties of Yellow Sarson collected so far from any part of India or abroad. The new type leaf (Fig. 1, extreme right) does not possess a broad terminal lobe like the normal type, but has a small terminal lobe with an acute apex. The incisions in the lamina do not touch the midrib and the lobes are not separated from each other. There is a distinct lamina along with the midrib. The lobes in the upper part of the leaf instead of being perpendicular like the normal type form an angle with the midrib. Its leaf character bred true in the succeeding generations.

In order to study the inheritance of the new type leaf, crosses were made in 1952-53 between the new type leaf individual and the variety, Pb. Sarson, bearing normal type leaves. The  $F_1$  shown in the figure (Fig. 1,

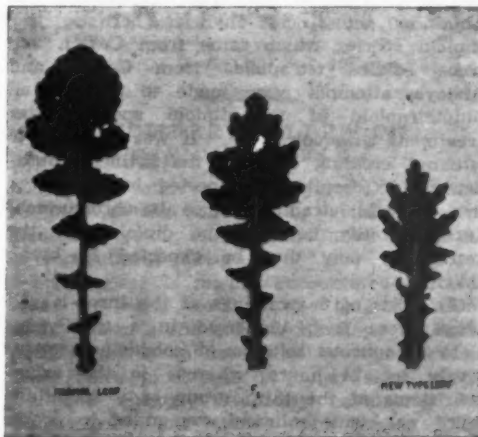


FIG. 1

centre), while closely resembling the new type leaf yet differs from it in certain characters. The incisions in the lamina in the lower part of the leaf are deeper and almost touch the midrib and at some places only a streak of lamina is left. However, the lobes are not widely separated from each other like the normal type leaf. The lobes in the  $F_1$  type leaf do not form an acute angle with the midrib like the new type leaf. Thus the characters of the new type leaf may be considered as partially dominant over the normal type leaf. In  $F_2$  the following results were obtained: New Type—137 plants;  $F_1$  type—314 plants;



Normal Type—162 plants.  $\chi^2$  value is 2.378 and P value is 0.10 to 2.0.

The  $F_2$  data give a good fit to a 1:2:1 ratio, the  $\chi^2$  value showing that the deviation is not significant. From this it may be concluded that the differences in the characters of the two types of leaves are controlled by one major gene and the characters of the new type leaf are partially dominant over the normal type. It is suggested that the new type leaf may be designated by the factor 'N' and the normal type by 'n'.

Govt. Res. Farm, DHARAMPAL SINGH.  
Kanpur, Uttar Pradesh,  
January 13, 1955.

### COLCHICINE INDUCED SECTORIAL CHIMÆRA IN *CYCLOSORUS REPANDULUS* (v.A.v.R.) CHING

*Cyclosorus repandulus* (v.A.v.R.) Ching is a diploid species with  $2n=72$  (Manton and Sledge<sup>1</sup>). Due to difficulties experienced in obtaining interspecific hybrids between this diploid species which came from Ceylon and some related tetraploids from Ceylon and Malaya, attempts were made to produce an autotetraploid of the diploid species after treatment with colchicine. It was intended to attempt crossing between the artificial autotetraploid (despite its expected low fertility) and the wild tetraploids, since the chromosomal incompatibility between the diploid and the tetraploids may thus be expected to break down.

Two sets of 6 sporelings at the three-leaved stage were each immersed in a 0.3% and 0.15% aqueous solution of colchicine respectively for 24 hours, whereas to the apical meristems of the third group of 6 sporelings 0.2% colchicine solution was added in drops. Then the treated sporelings were washed and potted in earthenware pots containing soil mixture made up of peat, sand and loam in the proportions of 3:2:1.

Root tips of individual plants were analysed by squash techniques, being slight modifications of the techniques used by Tjio and Levan<sup>2</sup> to suit plant materials of this fern species. Root tips were treated with half-strength aqueous solution of 8-hydroxyquinoline<sup>2</sup> in small specimen tubes, which were corked and kept immersed in running tap water (between 16-18° C. in Leeds) for 4-6 hours. This pre-treatment contracted the chromosomes appreciably for better spread.

The chromosome counts of these treated root tips were made in one of two ways: (i) This

was the same as outlined by Tjio and Levan<sup>2</sup> with the only modification that a saturated solution of orcein in 45% acetic acid was used instead of 2% orcein as recommended. (ii) When the number of separate root tips was too many to be analysed at a time, these were fixed in Carnoy's solution (4:3:1 instead of 6:3:1) after decanting the hydroxyquinoline solution, and left in the refrigerator at 4° C. to be squashed at leisure in the same way as in (i).

The above cytological analysis showed that only one of the sporelings treated with 0.3% colchicine solution produced roots, some of which possessed 72 somatic chromosomes (Fig. 1), whereas the others had 144 (Fig. 2).



FIG. 1



FIG. 2

Evidently, this plant has a sectorial chimæra derived by the doubling of the diploid chromosome complements of a sector of the root meristem by the action of colchicine, which, however, could not influence mitosis in the other sector, presumably due to its incomplete action on a large meristematic tissue of a sporeling at the three-leaved stage. Consequently, the two sectors produced tetraploid and diploid roots respectively during the ontogeny. This is the first recorded case where colchicine was used to induce autotetraploidy in ferns, resulting, however, in the production of a sectorial chimæra.

Grateful thanks are due to Professor I. Manton of Leeds for supervision and guidance. Ravenshaw College, G. PANIGRAHI.  
Cuttack, March 7, 1955.

1. Manton I. and Sledge, W. A., *Phil. Trans. Roy. Soc., London*, Series B, 1954, **238** (654), 127.
2. Tjio, J. H. and Levan, A., *Anales de la Estacion Experimental Aula Dei.*, 1950, **2** (1), 21.

### A NOTEWORTHY PHALLOID FROM AHMEDABAD

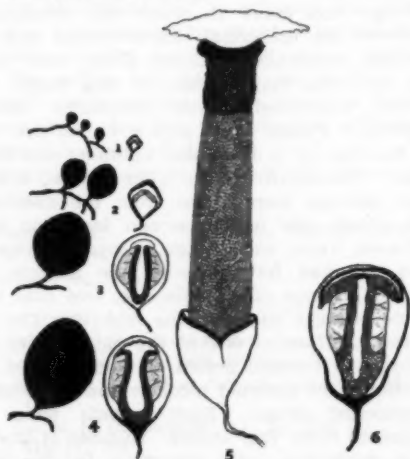
In the course of the studies on the higher fungi of Ahmedabad and its immediate environs, the author came across an interesting phalloid, *Itajahia gulericulata* Alfr. (Syn = *Phallus roseus* Delile; *Itajahia rosea* Fischer) occurring in abundance, on decaying vegetable debris under trees of *Melia azadirachta* L. They make their appearance in rainy season especially in August and September. Fischer,<sup>1,2</sup> Narasimhan,<sup>3</sup>



Petch<sup>4</sup> and Sultan Ahmed<sup>5</sup> have recorded the occurrence of various members of soil fungi belonging to the group phalloideae. However, the occurrence of *Itajahia galericulata* has been recorded only in the Punjab plains, where Sultan Ahmed<sup>5</sup> was able to describe only the mature plant. In the present paper a few interesting field observations are recorded.

This phalloid assumes bizarre shapes and appears in abundance during heavy rains. The mature specimens collected varied from 8-21 cm. in height and from 1.8-4.7 cm. in diameter (Fig. 5). The well grown stalk is turgid, and white or pale rose in colour. The stalk is generally circular in outline and sometimes flattened and stunted in growth. It is hollow, with mucilage, broad towards the apex and forms a distinct, thick, circular apical collar spreading over the gleba in an arch-like manner. The margin of the collar is either smooth or lacerated. The collar has a distinct apical cap, which is moderately thickened and has a regular or lacerated margin. The cap remains intact on the collar (if there is no disturbance) for a fairly long time.

Just beneath the collar the receptacle is situated. It is globose with white lamellate plates of sterile tissue traversing the gleba. The gleba surround the distal portion incompletely. It is dark, olive-green in colour, viscid and emits abominable smell.



FIGS. 1 to 4, 6. Various stages in the development of volva and their longitudinal sections,  $\times \frac{1}{4}$ .

FIG. 5. Mature plant,  $\times \frac{1}{4}$ .

The mycelium is composed of white, cord-like strand spreading widely on the rotting woody parts. It bears innumerable eggs from

the size of a pin's head to that of hen's egg (Figs. 1-4, 6). The eggs terminate short branches and mostly develop in groups and rarely in isolation. The growth of the egg depends upon the moist environment. If there is increased and continuous precipitation, the volva increases in bulk, and shows signs of rupture on the twenty-third day. However, with the onset of dryness, the volva of various sizes begin to rupture. First there is a split exposing partly the apical portion. Within 12-18 hours, the stalk of various sizes emerges out displaying the gleba with a well-developed collar and cap.

M. R. Science Institute, T. ANANDA RAO.  
Gujarat College, Ahmedabad,  
February 14, 1955.

1. Fischer, E., *Denkschr. Schweiz. Nat. Ges.*, 1890, 32.
2. —, *Ibid.*, 1893, 33, 1.
3. Narasimhan, M. J., *J. Ind. Bot. Soc.*, 1932, 11, 248.
4. Petch, T., *Annals. Roy. Bot. Gardens, Peradeniya*, 1908, 4.
5. Sultan Ahmed, *J. Ind. Bot. Soc.*, 1940, 18, 169.

#### A POWDERY MILDEW ON *CARICA PAPAYA* L.

A POWDERY mildew caused by an *Oidium* was recently noticed in Poona, causing severe damage to young seedlings of *Carica papaya* L. in horticultural nurseries.

The disease is mainly encountered in nurseries on young seedlings and is absent from adult plants. The mildew develops as small circular specks on both sides of young leaves, being more prominent on upper sides which gradually enlarge, ultimately enveloping the entire surface and making them turgid. Such leaves break off leaving a barren axis. The uppermost tender leaves appear to be more susceptible to the attack than the older ones. The mildew also affects the growing shoot in advanced cases, and causes severe "die back", ultimately killing it and imparting a blighting effect to the entire seed-bed area.

A powdery mildew caused by *Oidium caricae* Naock on *Carica papaya* was described from Brazil in 1898 and has been listed by Saccardo.<sup>1</sup> The occurrence of this mildew has also been reported on *Papaya* from Java<sup>2</sup> and the fungus causing it identified as *Oidium caricae* Naock, evidently on the basis of similarity of spore-character and measurements. A comparison of the *Oidium* spp. on *Carica papaya* reported from Brazil, Java and India in respect of spore

measurements and other morphological features is given in Table I.

TABLE I

Locality	Spore-character	Spore measurement	Authority
Brazil	Elliptical	23-25 × 14.5-20 $\mu$	Saccardo <sup>1</sup>
Java	Elliptical	26.6 × 18.6 $\mu$	Van Overeem <i>et al.</i> <sup>2</sup>
India	Barrel-shaped	31-46 × 13.7-23.4 $\mu$	..

It is clear from Table I that Indian *Oidium* is significantly different from the other two *Oidiums* in respect of its spore-characters and measurements and therefore appears to be a distinct morphological species. Unfortunately, no detailed description of the two exotic mildews, especially in respect of the conidiophores, haustoria and catenulation of the conidia, is available for comparison. However, the two characters of the Indian *Oidium*, viz., shape of conidia and their measurements are sufficiently distinct to justify description of this *Oidium*, as a new species.

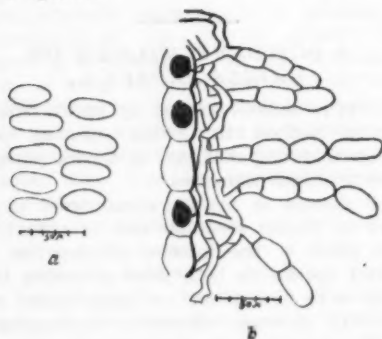


FIG. 1. (a) Conidia. (b) Section showing haustoria and conidiophores.

Accordingly, it is proposed to describe the Indian *Oidium* on *Carica papaya* as a new species with the following diagnosis:

*Oidium indicum*: Kamat spec. nov.

Mycelium, ectophytic, hyaline, creeping, 5-7.5  $\mu$  in width, forming sparse coating on upper surface of leaves; haustoria more or less globular, penetrate the epidermal cells; measure 16-20  $\mu$  in diameter, conidia hyaline, obovate to barrel-shaped, thin-walled, 31.2-46.8 × 13.7-23.4  $\mu$ , in chains of 3 to 5. Ascigerous stage absent.

Habitat: on young leaves and shoots of *Carica papaya* L., Poona, India.

The writer is grateful to Prof. M. N. Kamat for guidance and Mr. E. W. Mason of the Commonwealth Mycological Institute, Kew, England, for helpful suggestions.

The specimens have been deposited in the Herbaria of the Commonwealth Mycological Institute, Kew, England, and the Indian Agricultural Research Institute, New Delhi, India.

M.A.C.S. Laboratory, P. P. CHIDDERWAR,  
Law College Buildings,  
Poona-4, February 2, 1955.

1. Saccardo, S., *Sylloge Fungorum*, 16, 1026.
2. Van Overeem, C. and Schwarz, M. S., *Oidiaceae, Oidium carica* Noack, *Icones Fungorum Malynasium*, 1926, 16 (Original not seen) (*R.A.M.*, 1927, 6 42).

#### EPIDERMAL CHARACTERISTICS OF PLANTS IN RELATION TO DROUGHT RESISTANCE

ACCORDING to Keller,<sup>1</sup> Kolkunov<sup>2</sup> and Pavlov<sup>3</sup> the number and the size of stomata determine the drought resistance of plants. Recently Lal and Mehrotra<sup>4</sup> classified varieties of sugarcane as resistant and non-resistant to drought on the basis of the dimensions of stomata and epidermal cells. In the light of these findings an attempt was made to study the relationship between the epidermal characteristics and the drought resistance of barley C. 251 and wheat Pb. 591—the major crops of this tract.

The experiment was conducted during 1949-51. Plants were grown in earthen pots of the size 11" × 10" under optimum soil moisture. Twenty-five days after sowing epidermal peelings were taken from the middle of the dorsal side of the second leaf, and fixed between 9 a.m. and 11 a.m. Lloyd's<sup>5</sup> technique was followed for preparing the mounts. To obtain peelings of suitable size, two cuts were made at right angles to the mid-rib. The epidermal surface at one of the cut margins was held by a forceps, peeled off and plunged immediately in absolute alcohol; and prepared as permanent mount. Such mounts were also prepared from 'flag' leaves. Number of stomata and epidermal cells occurring in the same field of the microscope was counted under high power. Stomatal index was calculated from these figures. Dimensions of the cells were measured by a standardised micrometer. The results are summarised in Table I.

TABLE I  
Number and dimensions of stomata and epidermal cells in seedling and 'flag' leaves

Crop plants	Stomata			Epidermal cells		
	1949-50		1950-51	1949-50		1950-51
	Seedling	'Flag'	'Flag'	Seedling	'Flag'	'Flag'
	Number per 0.095 sq. mm.					
Barley	.. 5.80	9.00	10.80	16.50	20.50	23.50
Wheat	.. 4.57	7.00	7.83	14.00	17.00	18.67
	Dimensions (length) $\mu$					
Barley	.. 53.79	39.45	36.51	338.4	150.9	126.9
Wheat	.. 64.22	48.90	45.64	394.8	201.6	183.3
	Dimensions (width) $\mu$					
Barley	.. 6.10	7.07	7.07	22.72	14.44	11.41
Wheat	.. 6.52	10.01	9.62	25.96	19.66	18.16
	Stomatal Index					
Barley	.. 26.01	30.52	30.89			
Wheat	.. 24.58	29.14	29.55			

Barley was characterised by higher frequency but smaller size of stomata and epidermal cells and higher stomatal index as compared to wheat. A similar trend in the results was noted in the 'flag' leaves as compared to the seedling leaves. There was an inverse relationship between the number and the size of the cells.

Newton and Martin<sup>5</sup> stated that the structural modifications of leaves are effective in reducing the water loss during the initial period of drought and in allowing the cells to develop physiological resistance. The inherently superior drought resistance of barley observed by the author may also be due to these epidermal characteristics which create a suitable environment for the physiological adjustment under the stress of drought.

Thanks are due to Prof. N. K. Anant Rao for guidance.

Botany Dept.,  
B. R. College, Agra,  
February 10, 1955.

MAN MOHAN SINGH.

#### THE MICRONUCLEI OF *SPIROSTOMUM AMBIGUUM* EHRBG. (PROTOZOA: CILIATA)

MULTIMICRONUCLEATE ciliates are of considerable interest on account of the behaviour of the micronuclei in binary fission and also in conjugation. The intimate relationship that exists between the macronucleus and the micronucleus in ciliates has thrown into sharp focus the differences between them in structure, size, mode of division and function. In all cases where the macro- and micronuclei are single, it is well known that these two nuclei are division products of the synkaryon after conjugation. The differentiation of one into the large and amitotically dividing macronucleus and the other into the small micronucleus which divides by mitosis, are the basic facts noticed in the case of all ciliates where conjugation has been studied. The facts, however, are not so clear in species where the micronuclei are multiple. In cases where the micronuclei are not only multiple but also highly variable in number, the position is even more obscure. The manner in which this variation is produced, the origin of increased number of micronuclei, as well as their diminution at certain stages of their life-history, offer subjects of the utmost interest.

*Spirostomum ambiguum* is a fresh-water ciliate of large size (1-3 mm. long) with a beaded macronucleus extending almost the entire length of the body. The number of beads is subject to variation in different individuals as well as in different stages of life-history, but does not seem to have any special significance. Ten to fifty beads are common.

1. Keller, B., *Ber. Deutsch. Bot. Ges.*, 1933, **51** (10), 514, (*Biol. Abst.*, 1935, 5845).
2. Kolkunov, W., *Mem. Polytech. Inst. Kiev*, 1905, **5** (4).
3. Lal, K. N. and Mehrotra, O. N., *Bot. Gaz.*, 1949, **111**, (2), 193.
4. Lloyd, F. E., *Carnegie Inst. Wash. Pub.*, 1908, **82** (from *Plant Physiology*, by Miller, E. C., 1938, pp. 328, 399).
5. Newton, R. and Martin, W. M., *Canad. J. Res.*, 1930, **3**, 336.
6. Pavlov, K., *German Abst. Vestnik Ceskoslov. Akad. Zém.*, 1930, **6**, (6/7), 620 (*Biol. Abst.*, 1932, 15492).

The micronuclei are numerous and small but are quite easily visible in Feulgen preparations. They are circular in outline and are flattened disc-like bodies measuring  $1.8\mu$  in diameter. They lie close to the macronucleus and are quite often found inside it. The micronuclear number is subject to great variation. Organisms with as few as ten clearly discernible micronuclei along with those with a hundred micronuclei have been found in my material (Fig. 1). Bishop<sup>1</sup> mentions no specific num-

more than twenty. There is some reason to believe that a much larger number starts mitosis than completes the process.

The macronuclear changes during binary fission are also interesting. A fusion of the beads and their gradual condensation results in the production of a deeply staining polymorphic body (Fig. 2) which is hollow in the centre. Mitosis in the micronuclei is complete at this stage. The macronucleus now elongates into a cylindrical, filamentary body of a more or less uniform diameter, often of great length. A transverse furrow appears about the middle of the body and the macronuclear filament extends across the furrow and is constricted, as the animal divides into two.

The micronuclear number is lowest at the stage of maximum macronuclear condensation. But as the macronucleus elongates, the micronuclei start increasing in number and in a stage shown in Fig. 3 the micronuclear number is very high.

The manner of this increase is not known. Attempts are being made to determine it.

Dept. of Zoology, P. B. PADMAVATI,  
Central College,  
Bangalore, May 14, 1955.

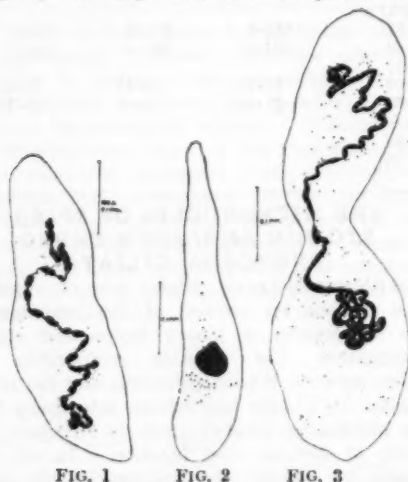


FIG. 1. A vegetative individual of *Spirostomum ambiguum* with macronucleus and a large number of micronuclei. FIG. 2. Stage showing macronucleus in a condensed state. The micronuclei are in telophase. FIG. 3. Binary fission, showing the cylindrical macronucleus and numerous micronuclei in cytoplasm.

ber found in her stocks but apparently discounts the earlier observations of Maupas<sup>2</sup> and Calkins<sup>3</sup> that the number of micronuclei bears a relationship to the number of macronuclear beads. Finley and Wanza,<sup>4</sup> in their paper on the effect of allyl isothiocyanate on *Spirostomum ambiguum* figure organisms with 4 and 6 micronuclei, suggesting that these are the normal numbers found in the species. My observations are very different. I have never found in my stocks any vegetative animal with less than 10 micronuclei. The average number, found in a count of 50 vegetative animals, was 40.

The point of interest in regard to the number of micronuclei appears during binary fission. At the approach of division the number of micronuclei is reduced and the number that takes part in mitosis is relatively small. This number too is subject to variation, but is often not

1. Bishop, A., *Quart. J. Microsc. Sci.*, 1923, **61**, 391.
2. Maupas, F., *Compt. rend. Pari.*, 1879, p. 1274.
3. Calkins, G. N., *J. Exp. Zool.*, 1910, **27**, 293.
4. Finley, H. and Wanza, J. W., *Trans. Amer. Microsc. Soc.*, 1949, **68**, 110.

#### EFFECTS OF SHORT PHOTOPERIODS ON A VARIETY OF EARLY RICE

SEEDS of an early variety of rice, B. 76 (Putia-Shankar) after a preliminary selection for uniformity and then sterilisation were sown on December 27, 1952, in seed-bed pots containing a mixture of rice-field soil and cow dung manure in the proportion of 9 : 1. Eight-hour short-day treatment (8 a.m. to 4 p.m.) was begun with 15-day old seedlings in the seed-bed stage on January 12, 1953. The seedlings were transplanted in 10" pots at the rate of 4 seedlings per pot on February 1, 1953, and the same short-day treatment was continued after transplantation till the time of ear emergence. On the whole there were 42 pots under the short-day treatment with an equal number of pots as control receiving the normal day length in the open space in the pot culture enclosure. The results of the effects of short photoperiods on the different aspects of growth and reproduction on this plant are given in Table I.



TABLE I

		26-2-1953	5-3-1953	12-3-1953	19-3-1953	26-3-1953	3-4-1953	21-4-1953
No. of tillers per plant	A	1.60	2.05	2.53	2.58	2.62		
	B	2.38	3.34	4.15	4.31	4.37		
No. of leaves per plant	A	4.75	5.15	5.38	5.52	6.28		
	B	3.57	4.09	4.41	4.87	5.89		
Height in cm. per plant	A	34.59	46.01	57.40	64.55	71.95	80.00	106.81
	B	29.18	44.28	51.21	55.76	63.46	72.88	98.03
Days from sowing to ear emergence	A		Main shoot		First tiller		Second tiller	
	B		111.34		116.19		125.14	
			102.74		104.87		107.34	

A—Short-day treated; B—Controls.

The results presented in Table I indicate that the treated plants take longer time for ear emergence, produce at all stages lesser number of tillers, greater number of leaves and grow taller than the control plants. So far as the delay in ear emergence in this variety is concerned, the result is quite in agreement with those obtained by Misra<sup>1,2</sup> with six early varieties of Uttar Pradesh, viz., T.N. 32, T.A. 64, T. 136, T.N. 22, T.N. 27 and Ch. 10, and by Sircar and Ghosh<sup>3</sup> with two early varieties, viz., Charnock and Panbira of Bengal. However, with some other varieties Sircar and Parija<sup>4</sup> have found no significant difference in the behaviour of the treated ones from the controls as regards the time of ear emergence.

The various responses of the variety B. 76 to the short photoperiod treatment in the present investigation may be explained on the assumption that due to short photoperiods, the concentration of auxin is greatly increased. This increased auxin level may have threefold action, viz., (a) promotion of vegetative growth resulting in the production of large number of foliage leaves and greater height of plants, (b) increasing apical dominance to a greater extent with the formation of lesser number of tillers, and (c) an inhibitory action on ear emergence resulting in a delay of 9 days in the main shoot, 11 days in the first tiller and 18 days in the second tiller.

We are thankful to the Utkal University for a grant-in-aid from the Jnan Vijnan Parishad Fund to carry on this investigation.

Dept. of Botany, G. MISRA.  
Ravenshaw College, B. SAMANTARAI.  
Cuttack-3, February 18, 1955.

1. Misra, G., *Curr. Sci.*, 1954, **23**, 233.
2. —, *New Phytol.*, 1955, **54**, 29.
3. Sircar, S. M. and Ghosh, B. N., *Nature*, 1947, **159**, 605.
4. — and Parija, B., *Proc. Nat. Inst. Sci. India*, 1949, **15**, 93.

### MODE OF ACTION OF ISO-NICOTINIC ACID HYDRAZIDE (INH)

EVER since iso-nicotinic acid hydrazide (INH) has been developed as an anti-tubercular drug, elucidation of its mode of action has been attempted by many workers. Thus Zeller<sup>1</sup> investigated the action of INH on the bacterial and mammalian diamine oxidase and found that the drug inhibits the enzyme systems. Yoneda and co-workers<sup>2,3</sup> studied the inhibition by the drug of the tryptophanase and amino acid decarboxylase activity of *E. coli* and found that pyridoxine hydrochloride competitively antagonizes this inhibition. However, Boone and Woodward<sup>4</sup> mentioned that the antagonism of the drug by pyridoxine hydrochloride is not competitive. Newberg and Forrest<sup>5</sup> found that INH competes with nicotinamide utilisation by the bacteria. Aronson *et al.*<sup>6</sup> found that INH inhibits the catalase activity of the tubercle bacilli, while Polster<sup>7</sup> could not find any inhibition of the catalase activity in the tubercle bacilli. Barclay *et al.*<sup>8</sup> studying the bacteriostatic action of INH using radioactive isotopes suggested that it might act by interfering with the formation of an essential metabolite. Zatman and co-workers<sup>9</sup> studied the action of INH on diphosphopyridine nucleotidase (DPNase) from various sources and suggested that the drug might act through the formation of INH-analogue of DPN. The inhibition of succinic oxidase by this drug has also been reported recently by Arora and Krishnamoorthy.<sup>10</sup>

In this communication, the authors have summarised the results of their studies on the action of this drug on some enzymes, using the Warburg manometric and the circular paper chromatographic techniques. The inhibitory action of the drug as also the sources of the enzymes are mentioned in Table I.

Table I shows that the drug inhibits, among several other enzymes, glutamic acid decar-



TABLE I

No.	Enzyme	Source	Method of preparation	Technique of estimation	Percentage inhibition at various drug concentrations		
					M/1,000	M/10,000	M/100,000
1	Respiration	Tubercle bacilli H <sub>37</sub> R <sub>v</sub>	..	Warburg manometric	38.5	23.1	11.5
2	Catalase	Rat liver	Gordon and Quastel <sup>16</sup>	do & titrimetric	64.0	34.0	10.0
3	Succinic oxidase	Sheep heart	Keilin and Hartree <sup>17</sup>	Warburg manometric	57.7	46.2	18.0
4	Cytochrome oxidase	do	do	do	42.3	20.5	7.7
5	Glutamic acid decarboxylase	<i>Clostridium welchii</i> SR <sub>12</sub>	Gale <sup>18</sup>	do	64.5	..	17.8
6	Transaminase	Rat liver	Green <i>et al.</i> <sup>19</sup>	do & chromatographic	45.0	10.0	5.0
7	Tryptophanase	<i>E. coli</i>	Wood <i>et al.</i> <sup>20</sup>	Colorimetric	68.3	61.7	57.5

boxylase, tryptophanase and transaminase, all of which require pyridoxal phosphate as co-enzyme. Yoneda and co-workers<sup>2,3</sup> reporting similar observations with tryptophanase, mentioned that the drug exerts its action by competing with pyridoxal phosphate. *In vitro* studies carried out in this laboratory regarding the antagonism between pyridoxine hydrochloride and INH as also on the anti-tubercular activity of desoxypyridoxine, could not confirm this postulation. Similar results are also reported recently by Boone and Woodward,<sup>4</sup> Biehl and Vilter<sup>11</sup> and Ungar and co-workers.<sup>12</sup>

The inhibition of cytochrome oxidase, succinic oxidase and catalase, by the drug are also noticed from Table I. In view of the chelating nature of the drug,<sup>13</sup> and the recent findings that INH is inactivated by hæmin<sup>14</sup> and by alkaline iron compounds,<sup>15</sup> and in consideration of the above inhibition of the iron-porphyrin system of enzymes, the mode of action of the drug may probably be through the fixing of the iron and thereby inactivating these enzymes.

The authors wish to thank Dr. K. P. Menon and Dr. K. V. Giri for their kind interest in this work. Their thanks are also due to Messrs. Unichem Laboratories, Bombay, for a gift of pure iso-nicotinic acid hydrazide, to Dr. Karl Folkers of the Merck & Co., Rahway, New Jersey, for a gift of pyridoxal phosphate

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P. R. J. GANGADHARAM.\*  
M. SIRSI.

Pharmacology Lab.,  
Indian Inst. Sci.,  
Bangalore-3, February 12, 1955.

1. Zeller, E. A., *et al.*, *Experientia*, 1952, **8**, 349.
2. Yoneda, M., *et al.*, *Nature*, 1952, **170**, 803.
3. — and Asano, N., *Science*, 1953, **117**, 277.
4. Boone, I. V. and Woodward, K. T., *Proc. Soc. Exp. Biol. Med.*, 1953, **84**, 292.
5. Newberg, C. F. and Forrest, I. S., *Arch. Biochem. Biophys.*, 1953, **45**, 237.
6. Aronson, J. D., *et al.*, *Proc. Soc. Exp. Biol. Med.*, 1952, **80**, 259.
7. Polster, M., *Lekarske Listy*, 1953, **8**, 556; *C. A.*, 1954, **48**, 4634.
8. Barclay, W. R., *et al.*, *Amer. Rev. Tuberc.*, 1953, **67**, 480.
9. Zatman, L. J., *et al.*, *J. Biol. Chem.*, 1954, **209**, 453, 467.
10. Arora, K. L. and Krishnamurthy, C. R., *J. Sci. and Ind. Res. (India)*, 1954, **13B**, 482.
11. Biehl, J. P. and Vilter, R. W., *Proc. Soc. Exp. Biol. Med.*, 1954, **85**, 389.
12. Ungar, J., *et al.*, *Lancet*, 1954, **220**, 267.
13. Albert, A., *Experientia*, 1953, **9**, 370.
14. Bonicke, R., *Naturwissenschaften*, 1954, **41**, 377.
15. Pansy, F. E., *et al.*, *Amer. Rev. Tuberc.*, 1953, **68**, 284.
16. Gordon and Quastel, *Biochem. J.*, 1948, **42**, 337.
17. Keilin and Hartree, *Proc. Roy. Soc. (London)*, Series B, 1937, **122**, 298.
18. Gale, E. F., *Biochem. J.*, 1945, **39**, 46.
19. Green, *et al.*, *J. Biol. Chem.*, 1945, **161**, 559.
20. Wood, W. A., *et al.*, *Ibid.*, 1947, **170**, 313.

\* Lady Tata Memorial Research Scholar.

GYNANDROMORPHISM IN *CULEX*  
*FATIGANS* WIED.

GYNANDROMORPHISM has been reported in the mosquito, *Culex pipiens-quinquefasciatus* and *Culex quinquefasciatus* by Middlekauff.<sup>1</sup> Rings<sup>2</sup> has made a record of a gynandromorph specimen of *Culex nigripalpus* Theobald, which exhibited the male type of antennae and palpi and the female type of abdomen and genitalia. Margaret and Samuel<sup>3</sup> have reported the find of another specimen of *C. nigripalpus*, which possessed a typical female type of antennae and palpi and a male type of abdomen and genitalia. It is the object of the present note to draw attention to another similar case of gynandromorphism in a species of *Culex*.

In these laboratories, a colony of the mosquito, *Culex fatigans* Wied., originally raised from<sup>4</sup> an egg raft of a gravid female brought from the field, has been maintained since September 1945. An average of 500 adult mosquitoes emerging from this colony were examined daily and the females were separated from the males for eventual use as test insects in the bioassay of insecticides. For the first time, a specimen of this species of mosquito exhibiting gynandromorphic characters was observed on 13-1-1955. It possessed the female type of abdomen and genitalia and antennae and palpi of male pattern as will be seen from Fig. 1.



FIG. 1

FIG. 2

FIG. 3

FIG. 1. Gynandromorph specimen of *Culex fatigans* Wied. FIG. 2. A typical male of *Culex fatigans* Wied. FIG. 3. A typical female of *Culex fatigans* Wied.

For comparison, Figs. 2 and 3 show typical characters of a male and a female, respectively.

Tech. Development Est. Lab., ALI AUSAT.

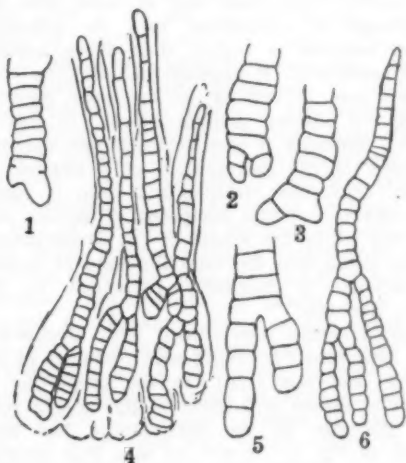
Kanpur, April 18, 1955.

T. KOSHI.

1. Middlekauff, W. W., *J. econ. Ent.*, 1944, **37**, 297.
2. Rings, R. W., *Ibid.*, 1946, **39**, 415.
3. Margaret, W. and Samuel, O. H., *Ibid.*, 1947, **40**, 139.
4. Newman, J. F. et al., *Proc. Ind. Acad. Sci.*, 1949, **30**, 61.

OCCURRENCE OF *IYENGARIELLA*  
*TIRUPATIENSIS* DESIKACHARY  
AT PACHMARHI HILLS

DURING a visit to the Pachmarhi hills (Madhya Pradesh) in October 1951, the authors collected an alga which agreed very closely with *Iyengariella tirupatiensis* which was described by Desikachary<sup>1</sup> from Tirupati in S. India. The alga has therefore been referred by them to this species.



FIGS. 1-6. *Iyengariella tirupatiensis* Desikachary (FIGS. 1, 2, 3, 5  $\times 478$ ; FIGS. 4, 6  $\times 290$ .)

The alga formed a thick crustaceous growth on the bed of a fast-flowing hill-stream at Pachmarhi. The individual filaments showed a more or less parallel arrangement, with two distinct portions, a lower creeping branched one and an upper erect unbranched one terminating in hairs. The alga showed true lateral branching and also pseudodichotomous branching. Heterocysts were absent in the alga. The filaments were 12.8-16  $\mu$  broad at the base. The trichomes were 4.8-9.6  $\mu$  broad in the basal portion and 2-3 (-6.4)  $\mu$  broad in the apical hair-portion. The cells were 3-4  $\mu$  long in the lower portion and 4.8-6.4  $\mu$  long in the upper portion. While the alga thus agreed with the Tirupati form in most respects, its branching, however, was comparatively more sparse, and its hairs also were not so long as in the case of the Tirupati form. These differences may perhaps be attributed to the very strong current in which the alga was growing at Pachmarhi.

This is the second record of this very rare and interesting alga in our country.

Saugar University, Sagar, T. V. DESIKACHARY.  
April 12, 1955. L. P. MALL.

1. Desikachary, T. V., *Phytomorphology*, 1953, 3, 249.

### PRESERVATION OF BUFFALO SEMEN IN GLYCINE BUFFER

It is common knowledge that the conception rate of artificially inseminated buffalo cow is very much lower than that of cows; also the percentage of conception rate in naturally served animals is higher than those inseminated artificially. It appears that this low conception rate is related to the poor keeping quality of diluted buffalo semen in citrate buffer. Recently it was demonstrated that the livability of the spermatozoa of a number of species (bull, boar, stallion and ram) is vastly improved in medium composed of glycine and egg yolk.<sup>1-3</sup> In the course of our investigations it was found that the total life-span of buffalo spermatozoa is markedly prolonged in the above medium.

Buffalo semen was diluted with glycine-egg yolk (prepared by mixing equal volumes of 4% glycine and egg yolk), in the proportion of 1 part of semen to 5 parts of glycine-egg yolk. The life-span of the spermatozoa has been shown in Fig. 1. It will be seen that whereas

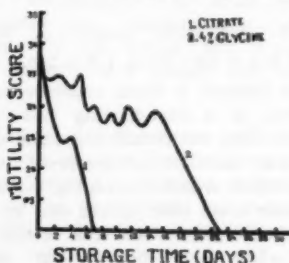


FIG. 1. Mean observation on the decline of motility of spermatozoa in nine split ejaculates diluted in (1) 3.6% citrate-egg yolk, and (2) 4% glycine-egg yolk and stored at 4° C.

the motility of the spermatozoa in citrate buffer declines very rapidly, it remains high in glycine-egg yolk for about 2 weeks and the total life-span is very markedly prolonged.

An insemination trial carried out with bull semen preserved in this medium had shown that the conception rate is slightly better than that obtained with semen preserved in citrate.<sup>4</sup> We have not yet been able to carry out any fertility test with buffalo semen preserved in glycine but it can reasonably be expected in

view of the results obtained with bull semen that such preserved buffalo semen samples would be fertile.

Dept. of Physiol. and  
Biochem.,

College of Vet., Sci.,  
Mathura (U.P.),  
May 2, 1955.

A. ROY.

R. K. SRIVASTAVA.

M. D. PANDEY.

1. Roy, A. and Bishop, M., *Nature*, 1954, 174, 746.
2. Roy, A., *Vet. Record*, 1955, 67, 330.
3. Ahmed, S. I. (Personal Communication).
4. Roy, A. and Bishop, M. (Unpublished data).

### THREE UNRECORDED COCCIDS ON GRAPE VINE (*VITIS VINIFERA*: N. O. AMPELIDAE)

1. *Laccifer lacca* Kerr. (Homoptera: Lacciferidae)

A GRAPE VINE, *Vitis vinifera*, infected by lac, was found in a private garden in Ranchi in February 1955. The grape vine, *Vitis vinifera*, was infected with the Rangeeni strain of *Laccifer lacca* Kerr. The vine bore lac insects of the Katki crop (June-July to Oct.-Nov. 1955) and also the current Baisakhi crop (Oct.-Nov. 1954 to June-July 1955). The lac insects had settled on the branches of the climber measuring  $\frac{1}{4}$ - $\frac{1}{2}$ " in diameter. The average number of young lac insects per linear inch was 165. The ratio of females to males being 1:2. The source of infection seems to have been accidental through the agency of birds, bats, squirrels or wind from lac-bearing ber (*Zizyphus mauritiana*) or Sharifa (*Anona squamosa*) trees situated at a distance of about 15' from the grape vine.

2. *Aonidiella orientalis* Newst. (Syn. *Aspidiotus orientalis* Newst.) (Homoptera: Diaspididae).

This scale insect was found in various stages covering practically the whole of climber and may be considered as a serious pest of grape vine (*Vitis vinifera*). Emergence of larvæ was observed from two females.

3. *Icerya aegyptiacum* Doug. (Homoptera: Coccidae)

Only two females of this scale insect were found on the climber. Emergence of larvæ was observed from one of them.

My thanks are due to Shri S. K. De, for drawing my attention to the lac-infected grape vine and to Mr. B. K. Purokayastha, Arboricultural Assistant of this Institute, for determining the specific name of the grape vine.

Entomological Section,  
Indian Lac Research Institute,  
Namkum, Ranchi,  
March 31, 1955.

B. P. MEHRA.

## REVIEWS

**6-Mercaptopurine.** By George H. Hitchings and 84 other scientists. (Annals of the New York Academy of Sciences, Vol. 60, Art. 2), 1954. Pp. 183-508. Price \$4.5.

The monograph presents a review of the present knowledge of 6-Mercaptopurine and opens with a discussion of the biosynthesis of nucleic acids as a background for discussion of the possible modes through which 6-Mercaptopurine may act. Its action on embryonic tissue is discussed by Bieber *et al.* who state that the activity is presumably directed against relatively undifferentiated cells. Thiersch using rats as experimental animals finds the most sensitive period of the foetus to the drug to be the time of implantation and 24 hours thereafter, i.e., the 7th and 8th day of gestation. Effects of 6-MP on tumours in tissue culture are reported by Bieseke. 6-MP is able to suppress cell division to a variable extent. In some neoplastic cell strains the mitotic inhibition is more pronounced than in several normal tissues tested. Its effect on experimental tumours in mice is described by Clarke *et al.* 6-MP inhibits the growth of sarcoma 180, prolongs the survival time of the host animal and causes a certain number of animals to recover from the tumour.

Several papers discuss the effect of 6-MP on experimental leukemia. 6-MP inhibits leukemic cell growth of leukemia L1210 and several other lymphocytic leukemias. Experiments to determine whether specificity of action of 6-MP with respect to leukemia is a fixed characteristic of the drug or whether it may be altered by the manner in which the drug is employed are discussed by Goldin. He finds it possible with aminopterin and A-methopterin as well as with 6-MP to increase the antileukemic specificity of the drugs by employment of appropriate schedules of treatment.

Toxic effects of 6-MP in mammal studied by Phillips *et al.* concern the potential hazards in therapeutic application. The effects are noted as damage to bone marrow, intestinal epithelium, disturbances in hepatic function and the possibility of liver necrosis.

Preceding the discussion of the clinical application of 6-MP is a most valuable, detailed review of the natural history of untreated acute leukemia by Tivey. He reviews and cor-

relates all relevant available publications on this disease and includes a bibliography of 228 papers on leukemia.

Clinical studies with 6-MP are discussed in 24 papers. The largest series on the clinical use of 6-MP is reported by Burchenal *et al.* who used it on 269 patients having various forms of neoplastic diseases. They discuss in detail mode of administration and clinical experience. A high percentage of remission was achieved with 6-MP in the early stages of myelocytic leukemia. It may cause remissions in patients resistant to A-Methopterin or cortisone. Hall's experience with the drug in acute leukemia is that an initial remission rate of 54% of the 24 adult patients was achieved. This initial remission rate is higher than those reported with folic acid antagonist or hormone therapy. Bernard and Seligmann from Paris treating 61 leukemias come to the conclusion that 6-MP therapy is indicated in cases of myeloblastic attack of chronic myeloid leukemia and in cases of acute leukemia resistant to other forms of therapy. Farber in his summary of experience with 6-MP reports that it produces hematological improvement in 50% of patients with acute leukemia; this improvement represents one-third complete remission and two-thirds hematological improvement. In his experience no patient responded to 6-MP who had failed to respond previously to cortisone and/or FAA. Combined therapy with cortisone and/or FAA shows no advantage over the use of single agents. The leukopenia encountered during 6-MP therapy does not always indicate drug toxicity but may represent an early phase of response to therapy. Most of the other papers report on smaller series of clinical evaluation of 6-MP and corroborate the above findings. This symposium gives a valuable summary of the knowledge available on the action of 6-MP in the laboratory and clinic.

HANNAH PETERS.

**Introduction to 3-D.** By H. Dewhurst. (Chapman & Hall), 1954. Pp. 152. Price 21 sh. net.

This is a small but comprehensive book dealing with all aspects of three-dimensional photography in motion pictures with chapters on wide-screen, cinemascope, cinerama and



stereo-television. The author is a research physicist and producer of films who has himself been responsible for a new form of single film stereo, and the book provides an instructive combination of basic theory and of its practical application which should be of keen interest to the amateur and professional alike.

After an exhaustive study of the monocular (movement, accommodation, perspective) and the binocular factors (convergence, parallax) in the perception of depth, the author studies the geometrical requirements which have to be fulfilled for "natural vision" and the corresponding projection requirements and methods. Various viewing aids such as integrating screens, shutter-occluding, anaglyphs, and the use of polarised light are described and then the author takes up various projection methods. In particular, the rotational beam splitting method—"a laboratory pre-occupation of the author for many years"—in which the left and right eye pictures occupying the two vertical halves of a frame are rotated each through a right angle by a prism system so as to give the usual horizontal format is discussed in some detail. The various distortions which occur and their corrective methods are studied, and the advantages of the wide screen and stereoscopic projection compared. A very useful book, which could be read with profit by those interested in the subject.

A. NARASINGA RAO.

**The Lipids. (Their Chemistry and Biochemistry), Volume II: (Biochemistry; Digestion, Absorption, Transport and Storage.)** By Harry J. Deuel, Jr. (Interscience Publishers, Inc., New York), 1955. Pp. xxvi + 919. Price \$ 25.00.

This book is the second volume in the series by the author on the lipids. The chemical approach to the subject is covered exhaustively in Volume I published in 1951. The present volume includes all available information on the digestion, absorption, transport (in the blood and lymph), and storage of fats and other lipids in the animal body. Volume III is to deal with biosynthetic, metabolic and nutritional aspects of the subject. The recent spectacular progress in these latter fields has necessitated this expansion in the scope for the biochemical topics being discussed in two volumes.

The contents fall into six sections dealing respectively with (i) the digestion and absorption of fats in the gastro-intestinal tract; (ii) the methods for the study of digestibility of lipids and various factors altering this diges-

tibility; (iii) the digestion, absorption and digestibility of lipids other than fats, viz., phospholipids, waxes, higher aliphatic alcohols, sterols, hydrocarbons, carotenoids, and fat-soluble vitamins; (iv) blood lipids, including the site of synthesis of plasma lipids and its turn-over—a subject of great importance in the study of arteriosclerosis and atherosclerosis; (v) the occurrence of lipids in different animal species, including a consideration of such subjects as storage of lipids under abnormal conditions, classification of fatty livers, and the role of lipotropic factors; and (vi) the distribution of lipids in specific tissues such as liver, kidney, brain, muscle, spleen, and the reproductive organs.

Although the monograph is concerned chiefly with the biochemical phases of lipids, some topics of a more chemical nature have been included such as the description of the chemistry and structure of bile acids which, of course, must be understood to ensure proper comprehension of the controversial subject of fat absorption.

This book is in many ways an excellent compilation and few, if any, could have attempted such an ambitious task as well as Professor Deuel has accomplished. Each chapter is a vast array of carefully organised and essential data with interpretations that are remarkable for their clarity and accuracy alike. The value of the book is enhanced by the up to date references to literature, compact tables, illustrated graphs and photographs. Professor Deuel has continued detailing the generic names of plant and animal sources, in addition to the author- and subject-indices as in Volume I. This treatise will, for many years, be an indispensable aid for study and reference to workers in the field.

Although priced rather high, praise is due for the infallible print and for the good quality paper used.

S. M. PATEL.  
A. SREENIVASAN.

**Methods of Biochemical Analysis, Vol. II.** Edited by David Glick. (Interscience Publishers, Inc.), 1955. Pp. vi + 470. Price \$ 9.50.

The volume under review is the second in the series of *Methods of Biochemical Analysis* edited by David Glick and follows closely the pattern set in the first volume published in 1954. There are 13 articles on different biochemical methods, in many of which novel experimental techniques developed in recent years have been



employed, and have been written by authors well known for their contribution towards the development or perfection of these methods. Thus, for instance, W. M. Sperry discusses the methods of lipid analyses, T. A. Jukes on assay of compounds with folic acid activity, G. D. Novelli on methods for the determination of coenzyme A, Z. Dische on new colour reactions for the determination of sugars in polysaccharides, and R. J. Winzler on determination of serum glycoproteins.

Special mention may also be made of the chapters on recent developments in techniques for terminal and sequence studies in peptides and proteins, the spectrophotometric assay of cytochrome C oxidase and the analysis of steroids by measurement in the infrared region. Dr. R. W. Lehmann has written on the determination of vitamin E in a style very different from that in which the other articles have been presented, and this may prove difficult for some to comprehend its full significance. The article on determination of glutathione by J. W. Patterson and A. Lazarow appears to be repetition of details contained already in the symposium on glutathione published in 1954, and Editor Glick could very well have given in its stead a method of biochemical analysis based on tracer technique. However, on the whole, one gets the impression that the different methods chosen have been very timely in this annual series, and that the methods have been presented in great detail as to be easily applied in the solution of many biochemical research problems.

A remarkable feature noticed on going through this volume is the manner in which the ultraviolet spectrophotometer has been pressed into service in so many of the recently developed methods. The get-up of the book is excellent and there is a subject as well as an author index in the end. The volume can confidently be recommended to those who wish to keep themselves up to date with the various methods and techniques in biochemistry.

P. S. SARMA.

**Gas Dynamics of Thin Bodies.** By F. I. Frankl and K. A. Karpovich. (Translated from Russian by M. D. Friedman.) (Interscience Publishers, Inc.), 1953. Pp. viii + 175. Price not given.

The original monograph in Russian was intended to bring together, for more widespread circulation, the latest work on the formulization of linearized problems of compressible flow theory and the methods of their solution. At the

time of its publication in 1948, these methods could only be found in the literature. The text, in fact, included an exposition of the method of solving the problems of supersonic flow over wings of finite span which is usually credited to J. Evvard. An English translation, therefore, seemed highly desirable.

The monograph consists of five chapters, the first of which contains a section describing the achievements of Soviet mathematicians. The later work refers to Western as well as Russian aerodynamicists who did pioneer work in solving the particular problems.

Chapter I contains a short survey and basic formulation of the problem with a method of solving the differential equation. Chapter II treats rigorously and in detail the compressible flow around bodies of revolution. Chapter III reviews work done before on wings of infinite span, in steady motion, compares linearised theory of bodies and wings, and introduces the new method of Mme. Krasil'shchikova (J. Evvard). Chapter IV treats unsteady flows and applications to the problems of supersonic propellers. Chapter V lists another method of solution, that of conical flow fields.

The volume will be highly useful to engineers, students in aerodynamics, and applied mathematicians in their study of the linearized problems of compressible flow theory. It should certainly make a fine text-book for a one-year special course in linearized supersonic aerodynamics.

**Technical Publications.** (*Their Purpose, Preparation and Production.*) By C. Baker. (Chapman & Hall), 1955. Pp. xiii + 302. Price 36 sh.

The dividing line between scientific and technical publication is perhaps a very useful one indicating that while the value of the former depends upon the quality of scientific imagination, that of the latter derives from the art of presentation. Technical publications—there are a variety of them extending from books to mere reports—serve the very useful purpose of presenting the results of research in a form amenable for development and industrial production. Their authorship naturally involves something of a technique, and this is sought to be supplied in the book under review.

The preliminary chapter on the forms of technical publicity introduces the would-be author to the variety of publications he may be called upon to handle. The next three chapters contain copious hints of a practical nature on the elements of authorship. Nearly 80 pages

are devoted in the course of two chapters to emphasise the value of illustrations. This is obviously a little overdone, considering that neither charts nor tabular statements receive much attention. The next two chapters deal with the technique of production and give useful hints on preparing the copy for the press, and proof correcting. The last two chapters on giving and getting aircraft and allied information and legal documents seem a little too specialised to need inclusion in a book of this nature.

The volume is bound to be useful to engineers, chemists and physicists and all others who have to assume the responsibility of authorship in any degree. But the definite impression remains that the value of the book will be much enhanced by a little judicious condensation.

**Fishing Boats of the World.** Editor: Jan-olaf Traung. (Published by the FAO.) (Arthur J. Heighway Publications, Ltd., London, E.C. 4), 1955. Pp. xx + 579. Price \$12.5.

*Fishing Boats of the World* deals with that part of fishing boat design which is missing from all text-books on naval architecture, and it provides, under one cover, a wealth of material contributed by architects, designers, engineers and other experts of more than a score of different countries, and it forms a valuable guide and reference work for all those in the fishing boat building industry.

The comprehensiveness and diversity of material in the book reflects the present knowledge in the industry and should advance intelligent application of the principles of naval architecture to the design of fishing boats.

Apart from the chapter dealing with research vessels, there are sections on boat types, materials, economics, naval architecture, safety at sea, engines, deck gear and factory ships. Each subject is covered comprehensively. For example, in the boat type section, various authors deal with short distance, surface, bottom and combination fishing. Under these headings they discuss critically the design and construction, qualities and defects of scores of boats from many countries. The boats examined range from dug-out canoes and beach landing craft up to the most intricate and advanced deep sea trawlers.

As Dr. D. B. Finn, Director of Fisheries Division, FAO, points out in his Foreword to the book, little has been done in the past to improve the design and construction of fishing vessels generally and the experts who have

contributed to this book are in agreement that it is time for science research and experiment to aid the fishing boat builder. Many contributors, especially the American experts, have dealt most frankly with failures in design, construction, and operation of a number of fishing craft through ignorance of 'sound principles of naval architecture' or through indifference to them.

#### Books Received

*Organic Solvents—Physical Properties and Methods of Purification—Technique of Organic Chemistry*, Vol. VII. Edited by Arnold Weissberger. (Interscience Publishers, Inc.), 1955. Pp. vii + 552. Price \$8.50.

*Preparation and Assay of Enzymes—Methods in Enzymology*, Vol. I. Edited by Sidney P. Colowick and Nathan O. Kaplan. (Academic Press, Inc.), 1955. Pp. xxv + 835. Price \$18.00.

*Experiments in Organic Chemistry*. Third Edition. By F. Fieser. (D. C. Heath & Co., Boston), 1955. Pp. 368. Price \$5.25.

*Transactions of Symposia in Applied Mathematics*, Vol. II. (Interscience Publishers, Inc.), 1955. Pp. 216. Price \$5.00.

*Bird Navigation—Cambridge Monographs in Experimental Biology*, Vol. III. By G. V. T. Matthews. (Cambridge University Press), 1955. Pp. vi + 140. Price 12 sh. 6 d.

*This Age of Science*. By E. J. Rowland. (Macmillan & Co., Ltd.), 1955. Pp. 125. Price 4 sh. 6 d.

*Electrical Characteristics of Overhead Lines*. By S. Butterworth. (The Electrical Research Association, Dorking Road, Leatherhead, Surrey), 1954. Pp. 238. Price £2-2-0.

*The Distribution of Sagitta Gazellæ Ritter Zahanoy—Discovery Reports*, Vol. XXVII. (Cambridge University Press), 1955. Pp. 235-78. Price 15 sh.

*Leukocytic Functions—Annals of the New York Academy of Sciences*, Vol. LIX, Art. 5. (New York Academy of Sciences), 1955. Pp. 665-1070.

*Polarographic Techniques*. By Louis Meites. (Interscience Publishers, Inc.), 1955. Pp. xiii + 317. Price \$6.00.

*The Nucleic Acids*, Vol. II. Edited by Erwin Chargaff and J. N. Davidson. (Academic Press, Inc.), 1955. Pp. xi + 576. Price \$14.50.

*Oil Equipment in Europe*. (Organisation for European Economic Co-operation, Paris-16), 1955. Pp. 136. Price \$1.25.

## SCIENCE NOTES AND NEWS

### A Simple Infrared Grating Spectrometer for use in Analysis

A simple infrared spectrometer has been designed by the U. K. Atomic Energy Authority specifically for use as a laboratory analytical tool. A Merton-N.P.L. replica grating is used as the dispersive medium, obviating the need for accurately figured mirrors yet giving resolution adequate for most analytical purposes. Additively coloured alkali halide crystals, which were specially developed for the purpose, are used to filter out unwanted spectral orders. Although capable of handling a wide variety of analytical problems, this prototype instrument was designed specifically to cope with the analysis of heavy water. With it the  $D_2O$  content of heavy water in the 99.5 to 100% range can be estimated with an accuracy of 0.003%. (*Royal Society Convezazione*, May 19, 1955.)

### High Altitude Research at Gulmarg

A symposium on High Altitude Research sponsored by the National Institute of Sciences of India was held at Gulmarg during May 27-28, in collaboration with the Gulmarg Research Observatory. The symposium organised by Prof. P. S. Gill, was well attended and the panel of speakers included Drs. K. R. Ramanathan, S. K. Mitra, K. S. Krishnan, B. Peters, R. C. Majumdar, L. C. Verman and many others. In all, about 70 original papers were presented. The deliberations will be published in the form of a bulletin by the National Institute of Sciences of India.

### Vapour Phase Chromatography

When a mixture is vaporized and the vapour is swept over a suitable static liquid phase, on an inert support, the components may travel at different rates depending on the boiling point and relative solubility in the static phase; as they emerge from the column the fractions are detected by thermal conductivity cells connected to a recorder. With suitable apparatus, very small samples can be analyzed rapidly and more completely than ever possible by distillation.

Exhibits presented at the Royal Society Convezazione—19 May 1955 by the Billingham Division, Imperial Chemical Industries, Ltd., show the analysis of a gas mixture at room temperature, of a low boiling liquid at 60°C. and of homologous long chain fatty acid esters

and alcohols at about 250°C. Each exhibit emphasizes certain aspects of this new analytical method, which is rapidly becoming one of the most valuable analytical methods in the organic chemicals industries.

### Improved Recording Spectrophotometer

According to an announcement from the Applied Physics Corporation, Pasadena, California, the Cary Model 14 Recording Spectrophotometer provides good performance to 1900 Å and even shorter wavelengths, through the use of optical elements of increased ultraviolet efficiency in the prism grating double monochromator. This region includes analytical possibilities for ketones, alcohols, monolefines, aromatics and several other compounds. Formerly, good performance below 2100 Å was possible only on custom-made instruments.

Although the prism grating double monochromator of the Model 14 has been known for its unusually high resolving power with low scattered light (less than a part per million) in the ultraviolet, visible and near infrared regions, the improved optical elements make it even more effective and provide the extended range, according to the manufacturers.

### New Medium for Telephone Transmission

A new and radically different medium for transmitting television and telephone conversations over long distances has been used successfully in experiments at the Bell Telephone Laboratories recently.

Waveguides made of solid metal tubing—roughly like a metal water pipe—have been widely used for some time for short distances. It would be possible to use these solid metal tubes for long distances if they were perfectly straight, but this is impractical. The new long distance waveguide is also a hollow tube, but it is constructed of thin copper wire, very tightly coiled—like a spring under pressure—and wrapped inside a flexible outer coating which holds the coiled wire in place. This type need not be straight and can actually carry signals around corners.

Experiments indicate that both the solid tube type waveguide and the new coiled wire or "helical" type of waveguide can be used together in communications systems, the first for short distances and the latter for long distances. The carrier frequency for the new

waveguide is about 50,000 megacycles. A major difference between transmission through the new waveguide and through previous systems is that the higher the frequency in the waveguide, the less the loss through attenuation. This is exactly the reverse, in other forms of transmission.

#### International Exhibition of Laboratory Equipment

The First International Exhibition of Laboratory Equipment (Science and Industry) will be held from 10 to 25 September 1955 under the auspicious of the Fédération des Industries Chimiques de Belgique and Société Chimique de Belgique. The Exhibition will be a part of the International Fair at Gand, Belgium. Those interested may obtain further details from Le Commissaire-General, Ing. Marcel De Cavel, Foire International De Gand, Palais des Florilies, Gand, Belgium.

#### Raptakos Fellowships for Medical Research

The Raptakos Medical Research Board will consider applications for the award of fellowships for research work on medical and allied subjects in recognized institutions situated in the Union of India. The awards normally consist of Rs. 3,000 per year for a Fellowship and Rs. 750 per year towards special equipments or chemicals approved by the Board.

Applications in the prescribed form (which may be obtained from the Secretary and Treasurer, Raptakos Medical Research Board, Dr. Annie Besant Road, Worli, Bombay 18), should be submitted before September 30, 1955, for grants commencing from January 1, 1956.

#### Colonel Amir Chand Trust Prizes for Medical Research

It has been decided to award during 1955 six prizes of the value of Rs. 300 each for the best published research work in any subject pertaining to all fields of medical sciences including clinical research, published by workers during the year 1954 (1st January to the 31st December 1954). The award of the prizes will be announced by the Indian Council of Medical Research, during November/December 1955.

The candidates are required to submit 15 reprints of their papers published during 1954. These should be sent to the Secretary, 'P' Block, Raisina Road, New Delhi, so as to reach him not later than the 1st September 1955. The papers should be accompanied by a short biographical sketch and two copies of passport size photographs of the worker or workers concerned.

#### New Source of Reserpine

C.S.I.R.O. Melbourne announce the occurrence of Reserpine in the bitter bark of *Alstonia constricta*, an Australian tree. (Reserpine is used in the treatment of high blood pressure and hypertension and is scarce throughout the world). *Alstonia* species exist over a large area of North-East Australia.

#### Current Ratings for Cables

The Electrical Research Association has released for publication a technical report on Current Ratings for Paper-Insulated Cables to B.S. 480: 1954 and Varnished-Cambric-Insulated Cables to B. S. 608: 1955. The report covers the revised edition of B. S. 480: 1954, including aluminium-sheathed cables. It takes account of the higher operating temperatures for certain cables which are now permissible by agreement with the Cable Makers' Association. The price is 5 sh. Limited supplies of this report are available from the Association at Thorncroft Manor, Dorking Road, Leatherhead, Surrey.

#### Award of Research Degree

The Ph.D. Degree of the University of Poona has been awarded to the following: Shri Shriram Vishwanath Pingale for his thesis entitled (i) Studies on Insect Damage in Stored Staple Foodgrains at Three Centres in Bombay State; (ii) Biology and Morphology of *Opatroides vicinus* Fairm.; and to Shri Raj Harkisan Duni-chand, for his thesis entitled "Detailed Study of Essential Amino Acid Content in the Milk of Indian Buffaloes".

#### Indian Council of Ecological Research

The Indian Council of Ecological Research at the Forest Research Institute, P.O. New Forest, Dehra Dun (India), is attempting to build an Ecological library. The Council trains teachers and post-graduate students in Ecological Research from Indian Universities and offers facilities to research workers for carrying on original work and in consulting Ecological works. Publishers of Ecological books, Ecological Societies and Ecologists are requested to help generously by sending as many of their publications as they can spare. Contributions will be gratefully received by Secretary of the Council: Dr. G. S. Puri, Ecologist, Forest Research Institute, Dehra Dun (India).

#### ERRATUM

In the review on 'Chemical Pathways of Metabolism', (1955, 24, 213, column 1) read heme for leme.



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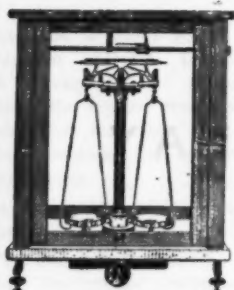
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